Office of Structural Materials Practices and Procedures Manual (OSMPP)

Material Engineering and Testing Services, Division of Engineering Services

APRIL 2005

State of California
Department of Transportation

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APPENDICES

DATE	SUMMARY OF CHANGES	PAGE
6/1/2003	**Section 1.2** Paragraph 10 corrected and modified	**1.2-3 & 1.2-4**
6/1/2003	**Section 1.3.3** –SMR Monthly Forecast Report deleted	**1.3-1**
6/1/2003	**Section 1.8.5 –** Form chart replaced w/website.	**1.8-4**
6/1/2003	**Section 1.8.5-1 –** Change in first paragraph..	**1.8-4**
6/1/2003	**Section 1.8.5-1 –** Minor changes	**1.8-5**
6/1/2003	**TL-6032 –** Minor change in paragraph	**1.8-7**
6/1/2003	**Section 2.2 –** moved to Section 3 -	**2.2-1**
6/1/2003	**Section 2.4.9 Structural Fasteners, Bolts -** has major changes and deletions. **Section 2.4.9 ends at 2.4-22 – Remove pgs. 2.4-13 – 2.4-26.**	**2.4-13- - 22**
6/1/2003	**Section 2.6.5** – Changes to Sections 2.6.5.1, 2.6.5.2, and 2.6.5.3.	**2.6.3**
6/1/2003	**Section 2.12 -** Major changes and **.**	**2.12-1 – 2.12-5**
6/1/2003	**Section 2.13 - WAS** Signs, Markers…**NOW** Overhead Sign Structures	**2.13-1**
6/1/2003	**Section 2.14 – WAS** Metal Culverts… **NOW** Signs, Markers…	**2.14-1 – 2.14-3**
6/1/2003	**Section 2.14 Signs, markers, and Traffic Safety Devices** :new section added – Section 2.13.6 Pavement Markers-Permanent and Temp Types only	**2.14-5**
6/1/2003	**Section 2.15 – WAS** Metal Pipe…**NOW –** Metal Culverts and Retaining Wall	**2.15-1**
6/1/2003	**Section 2.16 – WAS –** Special Composition… **NOW –** Metal Pipe**…**	**2.16-1**
6/1/2003	**Section 2.17 – WAS** Paint Epoxy… **NOW –** Special Composition, **REMOVE pg. 2.17-3**	**2.17-1 – 2.17-2**
6/1/2003	**Section 2.18 – WAS** Steel Piling… **NOW** – Paint Epoxy…	**2.18-1 – 2.18-4**
6/1/2003	**Section 2.19 – WAS** Commodities **NOW** Steel Piling	**2.19-1**
6/1/2003	**Section 2.20 – WAS** New or Unusual…**NOW -** Commodities	**2.20-1**
6/1/2003	**Section 2.21 Added Section –** New or Unusual Products	**2.21-1**
6/1/2003	**Section 3 –replaced** with changes from Concrete Committee.	**3.1-1 – 3.16-6**
6/1/2003	**Section 4.1.2.1 –** Change in #7 and # 8	**4.1-6 & 4.1-7**
6/1/2003	**Section 4.2.3 –** Minor change in first sentence	**4.2-2**
6/1/2003	**Section 4.4.2 –** Change in first paragraph.	**4.4-5**
6/1/2003	**Section 4.4.3.4 –** Change in sentence.	**4.4-8**
6/1/2003	**Section 4.4.3.6 –** Sentence change in second paragraph.	**4.4-10**
6/1/2003	**Section 4.4.3.10 –** change mid paragraph.	**4.4-13 – 4.4-16**
6/1/2003	**Section 4.5** Entire Section has been replaced.	**4.5-1 – 4.5-4**
6/1/2003	**Section 4.6.6.2** – Change last sentence, last paragraph.	**4.6-5**
6/1/2003	**Section B** – Changes	**B-2 - B-4**
6/1/2003	**Section H:** Now published	**H-2 – H-8**
	OCTOBER 2003 - SUMMARY OF CHANGES	
REMOVE and REPLACE Page 1.1-4 – Word change		
REMOVE Pages1.2-1 thru 1.2-5 -ADD Pages 1.2-1 thru 1.2-4 – New diagrams; Table pg. 1.2-3 moved to website.		
REMOVE and REPLACE Pgs 1.7-1 thru 1.7-2 -changes indicated by lines.		
REMOVE Pgs. 1.8-3 thru 1.8-10; ADD Pgs 1.8-3 thru 1.8-12, changes indicated by lines.		
REMOVE and REPLACE Pg. 2.2-1		
REMOVE and REPLACE Pg. 2.4-17 thru 2.4-18, changes in first paragraph. pg. 2.4-18		
REMOVE and REPLACE Pgs. 2.12-1 thru 2.12-6		
REMOVE and REPLACE Pgs. 2.13-1 thru 2.13-4;, changes indicated by lines.-		
REMOVE and REPLACE Pg. 2.13-6, changes indicated by lines.		
REMOVE and REPLACE Pgs. 4.1-1 thru 4.1-8, changes indicated by lines.		
REMOVE and REPLACE Pgs. 4.4-1 thru 4.4-4, changes indicated by lines.		
REMOVE and REPLACE Pgs. 4.4-9 thru 4.4-16, changes indicated by lines.		
REMOVE and REPLACE Pgs. 4.6-1 thru 4.6-4 changes indicated by lines.		
REMOVE and REPLACE Pg. 4.6-7, changes indicated by lines.		
REMOVE and REPLACE Pgs. A-1 thru A-4, changes indicated by lines.		
REMOVE Pgs D-9 thru D-14. No replacements – Checklist deleted.		
ADD Pgs. J-1 thru J-4, Replaces checklist removed in Appendix D.		
JULY 2004 – SUMMARY OF CHANGES		
Sub-Section DELETIONS: 1.1.2 QA Inspectors; 1.1.3 Lead Inspectors; 1.1.4 Structural Materials Representative		
REMOVE pages 1.1-1 thru 1.1-6 **ADD** pages 1.1-1 thru 1.1-4		
REMOVE and REPLACE pages 1.2-1 thru 1.2-4 – changes indicated by vertical lines.		

REMOVE pages 1.7-1 thru 1.7-2, **ADD** pages 1.7-1 thru 1.7-12, new additions start at 1.7.2.1
REMOVE and REPLACE pages 1.8-11 thru 1.8-12, changes in Figures 1.5 and 1.6
REMOVE and REPLACE pages 1.9-1 thru 1.9-4
REMOVE AND REPLACE pages 1.13-5 thru 1.13-6, change indicated by vertical line
APRIL 2005 – SUMMARY OF CHANGES
REMOVE AND REPLACE ENTIRE TABLE OF CONTENTS PAGES i through viii
REMOVE pages 1.1-1 through 1.1-4 **REPLACE** with pages 1.1-1 through 1.1-6 (Section 1) Page 1.1-1 deletion of Roadside Safety Technology Branch from Figure 1-1. all other changes indicated by vertical lines.
REMOVE AND REPLACE pages 2.4-15 through 2.4-22 minor change in paragraph 2.4.9.4 -
REMOVE AND REPLACE pages 2.5-1 through 2.5-4 , entire Section change and list added.
REMOVE PAGES 2.8-7 through 2.8-14 – REPLACE with PAGES 2.8-7 through 2.8-16. Section 2.9.4 Concrete Masonry Unit (Blocks) now 2.8.11. 2.9.5 Precast Reinforced Concrete Soundwalls now 2.8.12. Remainder of Section 2.9 Manufactured Clay Products deleted. Section 2.9 now Fencing , making number changes in the following Sections. **REMOVE PAGES 2.9-1 through 2.21-2** and **REPLACE** with **PAGES 2.9-1 through 2.20-2**
REMOVE AND REPLACE pages 3.1-1 thru 3.1-4; Section 3.1.1 has changed.
REMOVE pages 3.5-2 through 3.5-8 **AND REPLACE pages 3.5-4 thru 3.5-8** Vertical lines indicate changes
REMOVE AND REPLACE pages 3.5-13 through 3.5-18 vertical lines indicate changes
REMOVE AND REPLACE pages 3.8-5 through 3.8-8 vertical lines indicate changes
REMOVE AND REPLACE Section 3.15 – pages 3.15-1 thru 3.15-2 , entire Section has changed.
REMOVE pages 4.6-1 through 4.6-8 **REPLACE** pages 4.6-1 through 4.6-10 **Section 4.6** has changed as indicated by vertical lines
REMOVE pages H-1 thru H-8 **AND REPLACE WITH** pages H-1 thru H-7 **Appendix H** has changed.**-**

Section 1. Administration

1.1 ORGANIZATION

The Office of Structural Materials is the largest office under the Materials Engineering and Testing Services (METS) of the Division of Engineering Service in the California Department of Transportation (Caltrans). An illustration of the Division of Engineering Services organization chart is located at the following intranet site:

http://onramp.dot.ca.gov/hq/opea/pa/pdf/eng_service.pdf

OSM operates out of three locations in Sacramento, the Bay Area, and Los Angeles to efficiently complete its operations. Figure 1-1 below illustrates how OSM is organized.

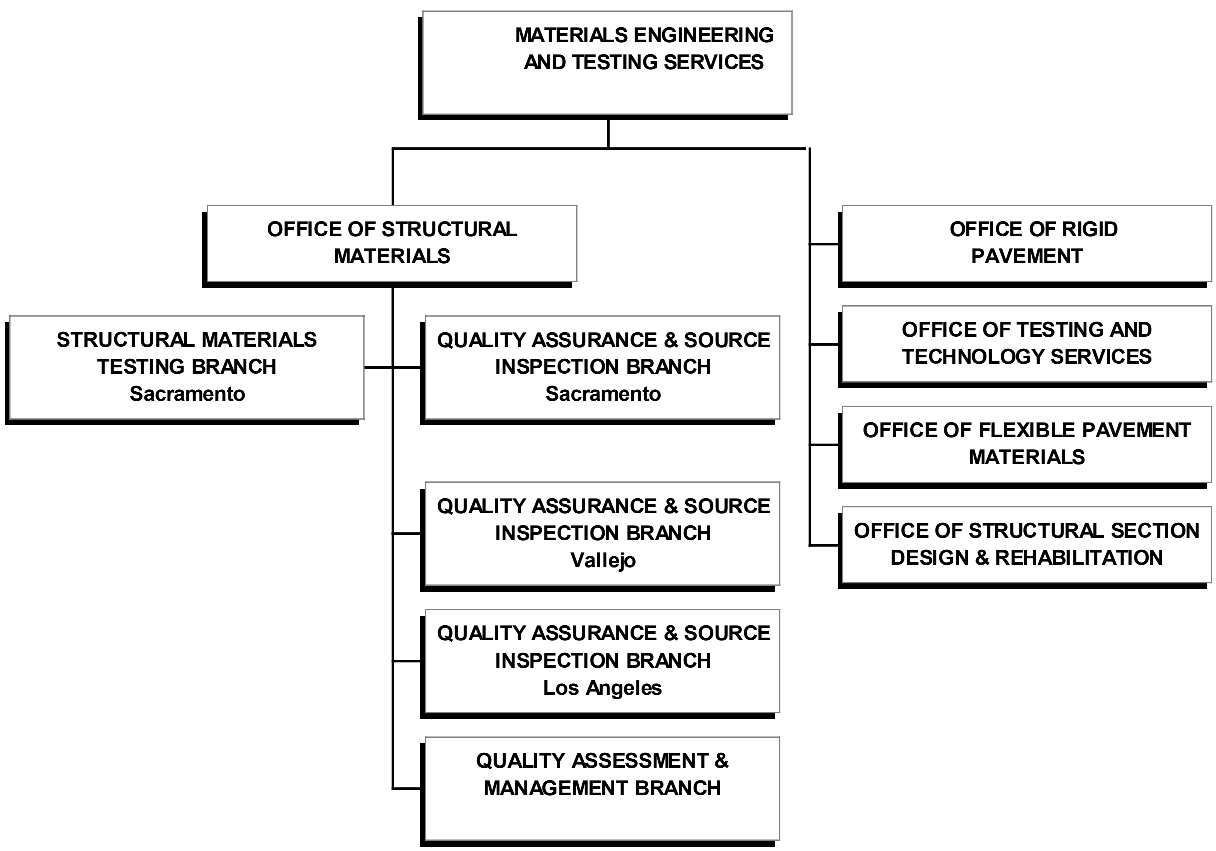

Figure 1-1. OSM Organizational Chart

The Office of Structural Materials is responsible for:

1. Inspection, sampling, and testing of structural materials and products for compliance with contract requirements to be used in all phases of highway

construction and maintenance, and coordination of these efforts throughout the Department.

2. Investigation of methods, tests and processes necessary for the proper selection and performance of structural materials and products used in all phases of highway construction and maintenance on California highways.

3. Development of standards and specifications for the proper selection, sampling, and testing of materials to be used in all phases of transportation construction and maintenance.

4. Consultation with all Headquarters and District Offices within the Department on matters related to structural materials and products used in all phases of construction and maintenance.

5. Maintaining a leading role in evaluation and development of structural materials, processes, and products for use in all phases of highway construction and maintenance through maintaining close contact with other materials and research agencies, public and private, and active participation in national and international professional and technical societies.

To accomplish the above responsibilities the Office of Structural Materials is divided into the following Branches:

1. The Structural Materials Testing Branch operates the structural mechanics laboratory. This group performs static and cyclic load tests on samples of structural materials submitted for compliance to specifications. It performs investigations conducts studies for new products submitted for inclusion in Caltrans' Standard Specifications.

2. The Quality Assurance and Source Inspection (QASI) Branches in Sacramento, Los Angeles, Bay North, and Bay Area South coordinate the inspection of all structural materials at fabrication facilities and constructions sites. These branches provide administrative and technical assistance to Resident Engineers and Structure Representatives throughout the state. Each branch is overall responsible for coordinating OSM's efforts for the construction projects in their geographic area of responsibility. While a construction project may be in one branch's areas of responsibility, another branch may conduct inspections and sampling of structural materials if the manufacturing or fabrication plant is located in their area of responsibility. These branches are the largest component of OSM. Currently approximately sixty inspectors and 17 engineers work out of these branches performing OSM duties at various construction sites, fabrication facilities, and manufacturing plants throughout the world.
3. The Quality Assessment and Management Branch coordinates the facility audits, acts as the liaison with industry, develops and publishes OSM forms, policy and procedures, coordinates technical input on specifications, maintains the Structural Materials Representative (SMR) database and maintains the OSM websites.

1.1.1 OSMPP Purpose

Inspection requirements have dramatically increased in the past several years due to a variety of factors. In the past OSM did not have the resources or inspectors to provide quality assurance on all construction projects. Many items were accepted based on a contractor supplied “certificate of compliance.” An analysis of OSM’s current practices identified several methods and procedures to provide more consistent quality assurance to its customers regardless of the size of the project. The Office of Structural Materials Practice and Procedure Manual (OSMPP) is part of OSM’s strategy to provide OSM customers with consistent, efficient and high quality service.

OSM Customers
Resident Engineers (REs) Structure Construction Representatives Contractors/Suppliers/Vendors

Table 1-1. List of OSM Customers

The analysis of OSM identified construction projects that did follow proper material release procedures. One of the reasons for this was OSM has historically only been able to “react” to source inspection requests. OSM depended on contractors and vendors to notify it of materials (DC-CEM-3101s) and inspection requirements (Inspection Requests). For large construction projects, experienced Resident Engineers or Office of Structure Construction Representatives ensured material was tagged and released properly. However, material for smaller construction projects would often be overlooked and incorporated into the construction job. The analysis identified a clear necessity to move to a more “proactive” role in the quality assurance process.

The practices and procedures detailed in this manual move OSM towards a more “proactive” role in the quality assurance process. OSM will assist REs in determining which contractors have not informed METS of materials to be supplied through DC-CEM-3101s. It will ensure inspection request are received for all “Notifications of Materials to be Furnished,” TL-608s, sent to vendors or suppliers. OSM will work to provide consistent quality assurance to its customers regardless of the size of the project. While this manual is a start, it is by no means a comprehensive answer to the many challenges OSM personnel face on a daily basis. All OSM staff is encouraged to recommend changes to this manual to provide better service to OSM customers and increase the efficiency of the office.

1.1.2 OSMPP Update Procedure

All users are encouraged to recommend changes to this manual to provide better service to OSM customers, increase efficiency in the office and to reflect current practice during the inspection process. However, changes to the OSMPP require concurrence from the Technical Committee Chairs and the Office Chief. The following is a chronological sequence for making updates to the OSMPP:

1. Technical Committee (TC) Chair makes a written request to the QAM Senior for an OSMPP Update. TC Chair attaches current OSMPP with specific redlined corrections and any required technical information. It may be helpful to schedule a meeting to discuss the specifics of the update before the first draft is prepared.
2. QAM Branch prepares Draft. (1week)
3. TC Chair and QAM Senior brief Office Chief on proposed revisions.
4. QAM Branch distributes Draft to TC Chair, Seniors and Office Chief for review. QAM Branch attaches a routing slip (Figure 1-2) to the Draft. The routing slip is initialed and dated by each reviewer.
5. All reviewers return comments to QAM Senior. (1 week)
6. QAM Branch meets with responsible TC Chair to discuss any changes. QAM Branch updates Draft. (1 to 2 days)
7. QAM Senior sends Draft to Office Chief and TC Chair for review. (1 week)
8. TC Chair and Office Chief send Draft back to QAM Branch for printing or correction.
9. If further corrections are required, they should be discussed between QAM Branch and TC Chair. (1 to 2 days)
10. When Draft is ready for printing, QAM Branch sends to the Administrative Assistant for typing. Administrative Assistant sends Final Draft to QAM Branch. (1 week)
11. QAM Senior meets with TC Chair and Office Chief to get final approval. (4 days)
12. OSMPP Update is printed and distributed by Administrative Assistant. (1 week)

OSMPP Update Routing Slip		
Name	**Date Received**	**Date Delivered**

Figure 1-2 OSMPP Update Routing Slip

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1.2 GENERAL PROJECT PROCEDURES

This manual specifies the practices and procedures for the Quality Assurance and Source Inspection (QASI) Branches located in Sacramento, the Bay Area, and Los Angeles. The areas of responsibility for each branch are indicated at the following website:

http://www.dot.ca.gov/hq/esc/Translab/smforms/StructuralMaterialsRepresentatives.doc

The basic administrative procedural steps these branches follow when inspecting structural materials are:

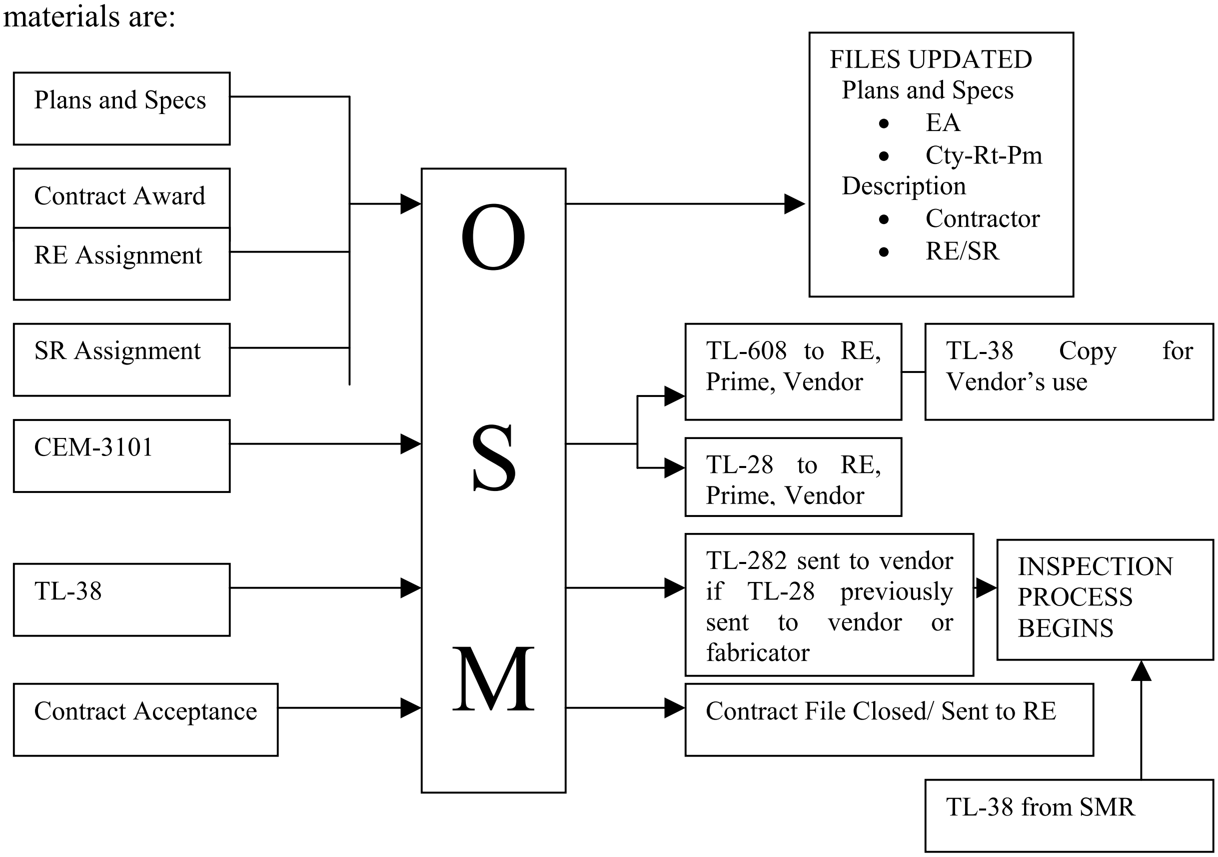

Figure 1-2. Basic Inspection Procedures

1. All QASI Branches receive a copy of the plans and special provisions prior to contract award for each state project. If plans are not received for a project in which OSM is performing inspection for, due to cooperative agreement, the designated SMR will coordinate with the responsible engineer to ensure OSM receives copies.

2. OSM receives notice of the Contract Award Summary and the administrative staff forwards a copy to the responsible QASI Branch. This summary will list the Prime Contractor, contract amount, project location, and the contract EA number.

3. OSM receives the form CEM-0101 "Resident Engineer's Report of Assignment", and forwards to the responsible QASI Branch. This form will list the Resident Engineer and their address assigned to manage the project. An updated list of Resident Engineers can be found at: http://www.dot.ca.gov/hq/construc/statement.html

4. Large projects with significant bridgework will have a Structure Representative. The Structure Representative typically handles most technical issues for larger projects, while the Resident Engineer focuses on the administrative portion of the project. An updated list of Structure Reps can be found at: http://dschq.dot.ca.gov/StructureRepList.asp

5. The primary item OSM receives is the form CEM-3101, "Notice of Materials to be Used" that lists vendors and fabricators providing material for the project. The administrative personnel at each branch receive CEM-3101's containing applicable items for OSM consideration. Upon receipt of each CEM-3101, OSM staff will determine if the material listed requires inspection. This determination is based off an approved list of bid items requiring inspection. If an item is not on the approved list, the designated SMR will determine if OSM will inspect the material. An updated list of bid items requiring inspection can be obtained at: http://onramp.dot.ca.gov/hq/esc/METS/StructMaterials/osm_docs_to.htm

6. If material listed on the CEM-3101 requires inspection, OSM Staff will send a TL-608 "Notice of Materials to be Furnished," to the vendor or fabricator, Prime Contractor and Resident Engineer. This document informs all parties that OSM will perform inspection and release of material prior to being sent to the jobsite. A TL-38, "Inspection Request Form" is included with the TL-608 sent to the vendor or fabricator. OSM administrative staff will ensure the correct OSM branch is annotated on the TL-38. The vendor or fabricator then faxes the TL-38 back to the appropriate QASI Branch to request an inspection date. In many cases the fabrication of certain bid items requires additional QA inspection as determined by the SMR. In these instances the designated SMR is also able to submit inspection requests via form TL-38 for execution by the appropriate branch. While the project may reside on one QASI Branch's area of responsibility, the branch responsible to perform the inspections is based on the location of the source inspection. Out of state and foreign inspections will be coordinated between all branches to minimize impact on OSM resources. Administrative staff will track all TL-608s sent to each vendor by project number (EA) and bid item number, and all TL-38s received by the branch.

7. If the material listed on the CEM-3101 does not require inspection, the inspection is assigned to the Resident Engineer through the use of from TL-28, "Notice of Materials to be Inspected ." The Prime Contractor and vendors are also sent a copy of the TL-28 in order to inform that source inspection is not required prior to shipment to the jobsite. When TL-38s are received by a QASI Branch for bid items that do not require source

inspection, a copy of the TL-282 will be sent to the vendor or fabricator in lieu of inspection request confirmation.

8. After performing each scheduled inspection, OSM inspectors ware required to document the daily QA inspection activity for each project or EA. The inspector will complete an inspection report (TL-6031, TL-6033 or TL-6034) for each location and inspection request they receive. When using a word processing program such as MS Word, inspection reports will be titled using the following format: EA_TL#_Lot#_Date_Location.doc. Example: Inspector X completes an inspection for concrete piles at Cal-Pipe in Stockton, CA, the piles are inspected and released to the jobsite on a TL-29 for EA 04-123456 on August 15, 2003. The inspector names the file: 04-123456_29_S08-118-03_8-15-03_CP.doc. The inspection report will document all of the QA inspection activity on the EA for that day. This can include taking samples, witnessing tests, conversations, not releasing material, etc. The inspector will complete a TL-29, Report of Inspection of Materials, a TL-6011, Component Material Inspection Report, or TL-6012, Report of Inspection of Stock Material, if releasing material that complies with contract requirements. If a TL-29, TL-6011, or TL-6012 is completed, the inspector will document any additional inspection activity conducted on the project (i.e. samples, material not released, test witnessing, conversations, etc.). If a TL-29, TL-6011, or TL-6012 is completed, it is not necessary to complete an inspection report. Inspectors should complete all reports on the day of inspection and will in no case complete the reports more than 24 hours after the completion of the inspection.

Example: Inspector X completes three inspections in one day. She releases material on a TL-29 at one location. She green tags material at the second location and inspects welding on steel pipe the third location. This inspector is required to complete a total of three reports:

Location #1:	TL-29	Document all activity on TL-29
Location #2:	TL-6011	Document all activity on TL-6011
Location #3:		TL-6031, Welding Inspection Report

Table 1-2. List of required reports an inspector may have to complete in a single day.

NOTE: Inspectors shall not provide copies of inspection reports to contractors.

9. Upon completion of each report, the inspector forwards his or her report(s) to their Lead Inspector. After reviewing each report, the Lead Inspector ensures the reports are distributed to the designated personnel as listed in Appendix A. The Lead Inspector will transmit inspection reports to the Inspecting Branch Senior, the SMR, the Resident Engineer, and the Structure Representative by electronic mail or facsimile. The Lead will also give a signed hardcopy (electronic signature applied by the signatory is acceptable) to clerical staff to route appropriately. Personnel will not apply another person’s signature. The Lead Inspector is also responsible for ensuring the reports are included in the Branch Monthly Summary Report. Lead Inspectors shall review all reports within 48 hours of receipt.

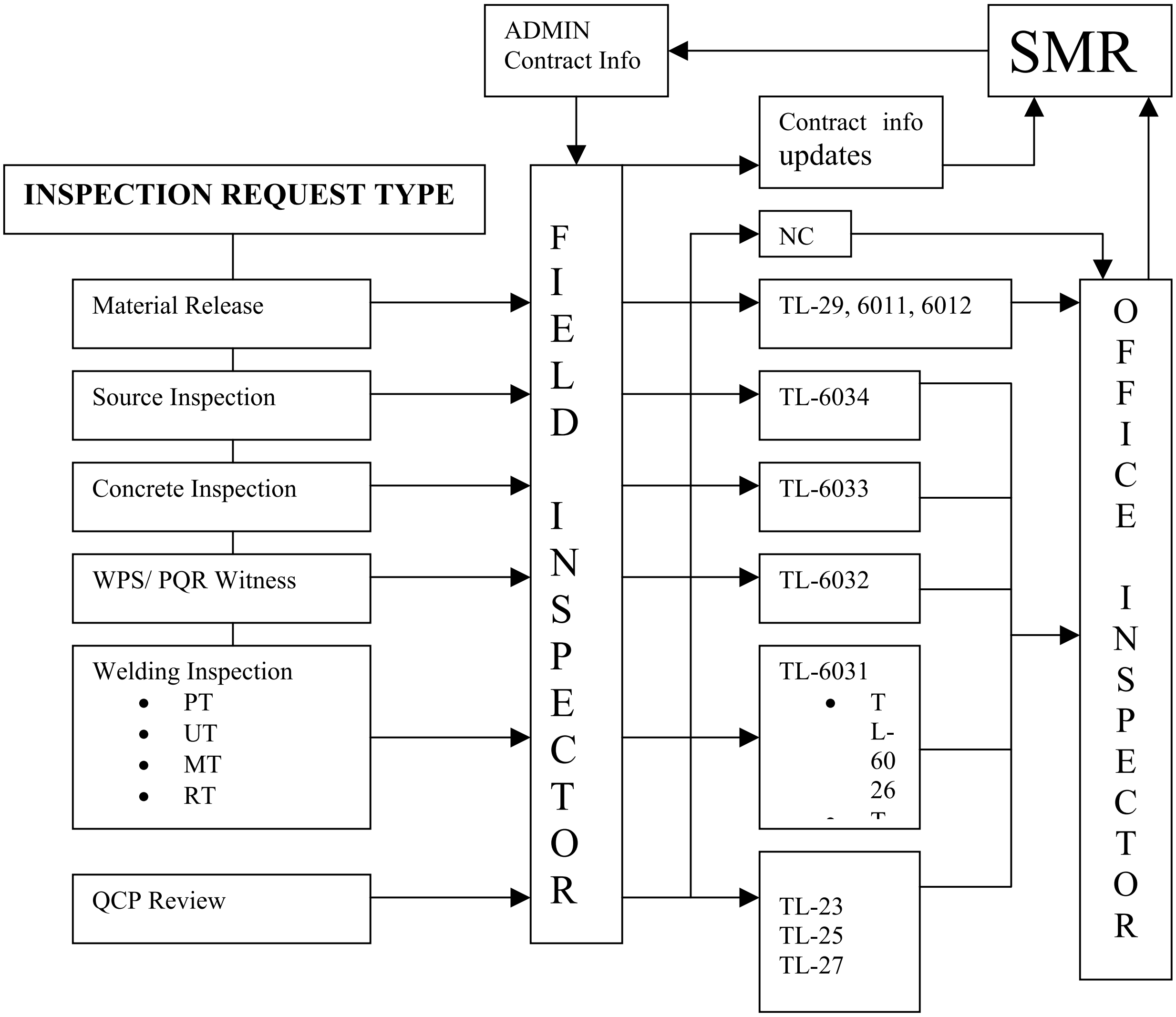

Figure 1-3. Illustration of the procedures of an OSM Inspector during a materials inspection.

1.3 MONTHLY REPORTS

1.3.1 Monthly Summary Report

The Monthly Summary Report listed in Appendix B will be submitted to the Office Chief no later than three working days prior to the monthly OSM Senior Staff Meeting. Each Senior will discuss their report at the monthly meeting. The purpose of the report is to provide objective data to assess the various workloads at each branch, determine resource requirements, identify training needs, and assess which projects have little or no OSM involvement.

The second page of the Monthly Summary Report lists the number of inspector on full time assignments (FTAs). Large Caltrans construction projects such as large bridges may require the full time assignment of inspectors at various fabrication facilities and manufacturing plants throughout the world. During these projects, it is more cost efficient for OSM to permanently assign an inspector to remain at a single location performing inspections. Currently, OSM maintains inspectors at fabrication facilities in Japan, Brazil, the United Kingdom, Oregon, and several more within the continental United States. During these assignments, the inspectors follow the same procedures described above except for the requirement for a TL-38, Inspection Request. Locations assigned a full time inspector are exempt from sending OSM TL-38s.

Instructions for completing the Monthly Summary Report are listed in Appendix B.

1.3.2 NCR Summary Report

The NCR Executive Summary Report will be submitted to the Office Chief no later than three working days prior to the monthly OSM Senior Staff Meeting. Each Senior will discuss the NCR's in their area of responsibility at the monthly meeting. The report will include all NCR's generated within the last month as well as all NCR's currently outstanding. The report will provide discussion of the resolutions and/or pending resolutions of each NCR. Each SMR will submit their report to their respective Branch Senior by the 10th day of each month.

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1.4 TRAINING

1.4.1 Quarterly Training

Training is critical to the success of OSM. OSM conducts quarterly training at each branch location (Sacramento, Emeryville, and Norwalk). While the many demands of inspections often make training challenging, Branch Seniors will ensure they balance the inspection requirements with required training. All inspectors are required to attend the OSM quarterly training unless directed otherwise by the Branch Senior. Inspectors who miss the required training at one location will discuss with their Branch Senior how to make-up the training at one of the other branches.

1.4.2 OSM Training Team

The OSM Training Team consists of a group of five to six inspectors that assists management in identify training needs for inspectors. This Team meets regularly to recommend changes to the current schedule, assess past training, and identify new training topics not scheduled.

1.4.3 NDT Training

The OSM Training Team and Branch Seniors have identified a need for more Nondestructive Testing training. To accommodate this requirement, the OSM Senior Level III, will conduct training every month at separate OSM locations. The training will repeat for three months to ensure each branch receives the same instruction. Branch Seniors working with Lead Inspectors will determine which inspectors are required to attend.

1.4.4 Engineer Training

All SMRs are required to attend quarterly training. SMRs will identify topics and training needs to their Branch Senior at their regularly scheduled SMR meetings.

1.4.5 Administrative Staff Training

All Administrative Staff are required to attend all schedule administrative training. Admin staff will identify topics and training needs to their Branch Senior as needed.

1.4.6 Safety Meetings

OSM Branches will conduct safety meeting in accordance with the established office policy. These meetings will be held at least once every two weeks.

1.4.7 Training Calendar

A current OSM training calendar is located on the OSM intranet site

http://onramp.dot.ca.gov/hq/esc/METS/StructMaterials/osm_docs_to.htm

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1.5 QASI BRANCH AUDITS

Branch Audits will be conducted at least once a year for each QASI branch. During the audit, two Branch Seniors from another OSM branch will visit the QASI branch being inspected to evaluate their practice and procedures. The purpose of the audit is to ensure all three branches are using consistent practices and procedures. The audit will also enable the seniors to better evaluate the current practices in their own branch. A copy of the current QASI Branch Audit is located in Appendix I.

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1.6 OSM TECHNICAL COMMITTEES

OSM has created four technical committees to serve as OSM's technical advisors on specification issues, training, and annually update the associated chapters of this manual. The four committees are responsible for the following materials:

Precast & Prestressed Concrete: Precast and Prestressed concrete materials; pre-cast and pre-stressed products; prestressing procedures; post-tensioning procedures; grouting; formwork; placement of reinforcing and pre-stressing steel; mixing; curing; repairs and surface finishing; storage, handling, and shipping.

Welding & Steel: Welding quality control issues; structural steel, steel piling; sign structures; luminaries and signal poles, metal castings and forgings.

Mechanical Testing: Structural fasteners, bolts, splices, concrete reinforcement, epoxy coated rebar, couplers, concrete anchors, threaded rod, CTM management and product approvals.

Source Inspection: Elastomeric bearing pads; bearings; galvanizing; sealing and waterproofing products; timber; clay products; fencing; guard rail; culverts and retaining wall

Each committee will consist of one Branch Senior, one SMR, and two inspectors. The committees will meet at least twice a year to discuss training needs, OSMPP revisions, and any specification reviews.

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1.7 QASI BRANCH DUTIES AND RESPONSIBILITIES

1.7.1 Branch Senior

Branch seniors have overall responsibility for their assigned branch. They supervise inspectors, engineers, and all administrative staff. They are responsible for the following:

- All OSM staff within branch accomplish their responsibilities
- All SMR monthly summary reports are submitted on time
- The Branch Monthly Summary Report is submitted to OSM no later than three working days prior to the OSM Senior meeting
- Review inspector reports on a weekly basis
- Perform an audit on other branches twice a year.
- All OSM staff will participate in required training.
- Performing bi-weekly safety meetings.
- Chair one OSM technical committee
- Discuss Monthly Summary Report at monthly OSM Senior Meetings

1.7.2 Structural Materials Representative (SMR)

1.7.2.1 General

The Structural Materials Representative (SMR) is the single point of contact between OSM and Construction. The Primary responsibilities of the SMR are to:

1. Meet regularly with the Branch Senior and Construction to establish and maintain open lines of communication throughout the life of the contract.
2. Provide clear, effective and timely structural materials recommendations to OSM clients.
3. Assist Branch Seniors and the Office Chief by identifying resources needed to accomplish OSM's quality assurance and source inspection responsibilities.
4. Anticipate and resolve any issues associated with quality assurance and source inspection while maintaining standards, consistency, contract schedule and contract cost.
5. Serve as a METS point of contact on materials issues for assigned projects.

SMRs are assigned either to a single, large contract or to a geographic area that includes multiple contracts. District boundaries are generally used to define the geographic areas of responsibility; however, some areas are further separated by counties. The OSM Internet site (www.dot.ca.gov/hq/esc/Translab/smb.htm.) provides a list of SMR assignments.

The SMR serves as the METS point of contact for issues or questions that Construction may have regarding other offices within METS. For these questions, the SMR directs the individual to the appropriate personnel within METS that have the knowledge and expertise to answer the questions. The SMR directs subject-specific questions to individuals on the list of contacts on the OSM Internet site. (www.dot.ca.gov/hq/esc/Translab/smb.htm.)

1.7.2.2 Contract Specific Roles and Responsibilities

The SMR manages structural materials issues throughout the life of a contract: from prior to contract award through contract completion.

1.7.2.2(1) Prior to Contract Award

- **Type Selection Meeting**

Structure Design may request OSM representation at a type selection meeting. Prior to the meeting, Structure Design sends OSM a review package. The SMR provides comments at the type selection meeting.

- **Review Plans, Specifications and Estimates (PS&E) Package**

The SMR reviews PS&E packages for quality assurance requirements when requested by the Designer or Specification Engineer. For contracts involving structural steel, precast concrete, or fabricated seismic components, OSM may receive a copy of the draft contract documents for review. The SMR's review focuses on parts of the plans and specifications impacting OSM. The goal of the OSM review is to verify that Department source inspection criteria and standards are met and to make any necessary material engineering recommendations. Additionally, the review identifies potential conflicts and ambiguities related to inspection criteria and standards. Generally, most contracts have well-established source inspection criteria; however, some contracts have special criteria or standards. Section 1.15 of this manual details the procedures to follow when conducting a PS&E review.

1.7.2.2(2) After Contract Award

SMRs assigned a geographic area of responsibility may not be involved with specific contracts prior to the award of the contract, and the award may be the first indication that METS involvement is required. The SMR can determine contract assignments in a number of ways: the "METS SMR Database" maintained on the OSM common drive in Sacramento, the Caltrans list of On-going contracts, Construction's Oracle database, the Structure Construction list of assigned Structure Representatives (SR), received Contract Award Summaries, and Resident Engineer (RE) job assignments. With smaller contracts, the SMR makes a special effort to ensure the RE understands the source inspection process. Many times the RE on a small contract will not have extensive experience in dealing with material acceptance procedures. An SMR may receive notice of a Local Assistance or Minor B project, contracts which are difficult to track. The SMR can try to get advance notice of Local Assistance and

Minor B contracts by keeping in contact with REs and SRs. The SMR takes an active role in providing equally consistent quality assurance measures on small and large contracts.

- **Initial Inspection Estimate**

Upon contract assignment, the SMR conducts an initial inspection estimate – a detailed analysis of the Contract's bid items, special provisions, and plans. As a minimum, the SMR:

1. Determines bid items and associated components requiring a "Notice of Materials to be Used," (CEM-3101). Some bid items, such as mobilization and clearing and grubbing, do not have materials components and a CEM-3101 will not be needed.
2. Maintains a list of bid items and their components for CEM-3101s received.
3. Determines an initial tier and inspection priority for bid items and their components and subcomponents and determines the appropriate OSM response (TL-28 or TL-608) for yet to be submitted CEM-3101s.
4. Determines items that must conform to the precast requirements of Section 8-2 of the Special Provisions. These items will require a completed Department audit of the precast plant, a pre-precast meeting, submission of a Precast Quality Control Plan (PCQCP), and regular in-process inspections.
5. Determines items that must conform to the welding requirements of Section 8-3 of the Special Provisions. These items will require a pre-weld meeting, submission of a Welding Quality Control Plan (WQCP), and regular in-process inspections. Check the special provisions for nondestructive testing (NDT) for steel pipe piling – QC personnel performing ultrasonic testing (UT) for field welds must verify their qualifications prior to performing NDT by both written and practical exams.
6. Determines which items require specific types of non-destructive testing and forecasts the necessary resources by quarter a year in advance.
7. Determines items that require testing by the OSM material lab.
8. Determines materials that may require in-process inspections.
9. Determines out of state travel requirements based on location of suppliers listed on the CEM-3101s.
10. Determines items that have steel reinforcement splicing requirements.
11. Determines if the Contract has a "Buy America" requirement.
12. Determines which materials and sources may require full time inspection

- **Resource Forecasting**

The SMR performs a Resource Forecast to help predict, document and allocate the upcoming workload. The SMR plans accordingly by first documenting material testing quantities, and then developing personnel requirements.

The SMR first reviews all available contract documents, noting materials that require testing by OSM. After generating the list of materials to be tested, the SMR estimates total quantities.

Material quantities can be provided by Structure Construction or taken from the list of bid items in the special provisions. The SMR estimates the quantities of Quality Assurance (QA) samples for each material type that requires testing. The special provisions or reference test methods note the sampling frequency of QA testing. If the special provisions do not note job specific sampling frequencies, the SMR refers to this manual or the lab supervisor in Sacramento. During this review, the SMR notes any testing turnaround times dictated by the special provisions. Close attention must be given to items that require a quick turnaround of QA testing results (ultimate butt splice tests, for example). The lab values this information, as it helps identify potential bottleneck areas in testing schedules.

With this information, the SMR starts the forecast by separating the materials to be tested into categories. In each category, the SMR explains the types of materials to be tested, the estimated quantity totals, and QA testing quantities with the required testing turnaround times. Next, the SMR estimates peak testing times by using the contract schedule, if available, or estimates according to the anticipated construction schedule.

The SMR forecasts personnel requirements. If the contract schedule is not available, or there is no Contractor yet, the SMR creates a rough estimate of personnel. The SMR should work with Construction and the contractor to obtain updated fabrication and production schedules to best determine inspection requirements. If no information is available, the SMR can compare the contract to other similar contracts. The estimates must take into account the types of non-destructive testing needed and the certified staff those inspections require.

As information becomes available, the SMR continually refines estimates. It is important the SMR includes time and personnel required to attend pre-fabrication meetings, pre-fabrication audits, and pre-construction meetings. With all of this information, the SMR uses a spreadsheet to plot personnel requirements throughout the duration of the contract.

Finally, the SMR compiles the quarterly SMR Forecast Report. The report breaks down personnel requirements for each project by quarter for the next 12 months. The personnel requirements are further identified as follows.

1. SMR
2. ASMR
3. Steel
    a. CWI
    b. UT
    c. RT
    d. MT
    e. PT
4. Concrete
    a. PCI Level I
    b. PCI Level II
    c. CTM
5. Source Inspection

The SMR regularly updates, forecasts and discusses resource requirements at the monthly SMR meeting.

- **Materials Meeting**

When the initial inspection estimate is complete, the SMR contacts the RE and SR to coordinate a materials meeting at the jobsite. The SMR discusses the procedures METS uses to support Construction, including a general approach to how METS receives contract documents – addendums, design drawings, shop drawings, quality control plans, submittals, Requests for Information (RFI), and any other contract correspondence which affects source inspection or clarifies contract requirements. The SMR also explains OSM's materials release procedures and NCR notification procedures and protocol.

During the materials meeting, the SMR reviews OSM's role in the contract and discusses OSM's understanding of Standard Specification Section 5-1.01 "Authority of the Engineer." The RE administers the contract. When the RE's interpretation of the contract documents is not consistent with OSM's, the SMR obtains the RE's written interpretation before the SMR finalizes an SMR Report. OSM accepts only the RE's written interpretation of the contract documents.

The SMR stresses the need for timely submittals of the CEM-3101. The SMR discusses material requirements unique to the contract, potential source inspection issues, specifics of OSM's source inspection plan, and OSM's reporting and distribution system. When discussing the reporting system, the SMR clearly explains the purpose of non-conformance reports (NCR) and the importance of timely, properly documented resolutions.

At the materials meeting, the SMR:

1. Discusses any materials issues Construction may have.
2. Provides a list of materials requiring a CEM-3101.
3. Schedules pre-weld and pre-precast meetings.
4. Determines a general approach to inform OSM of contract addendums, change orders, pertinent contract correspondence, and working drawings.
5. Determines if the pre-construction meeting with the Contractor has occurred and requests to be included.
6. Provides a list of material-related submittals that must be received and reviewed by OSM.
7. Discusses appropriate construction meetings in which the SMR's participation would benefit the contract.

- **Pre-construction Meeting**

The SMR requests to attend the pre-construction meeting with the RE, SR and the Contractor. With the RE or SR's permission, the SMR discusses many of the items from the initial inspection estimate. At a minimum, the SMR discusses the following items:

1. CEM-3101. The SMR stresses the importance of this document. The SMR is clear with the Contractor that OSM will not provide any source inspection for vendors or subcontractors until a CEM-3101 has been received by the Department. The SMR requests CEM-3101s be submitted within 30 days of the meeting.

2. QC/QA Roles and Relationships. The SMR clearly explains that quality control (QC) is the Contractor's responsibility, regardless of whether a Department representative is present in a fabricator's or vendor's shop. OSM inspectors release material only after verifying the Contractor's QC procedures comply with contract requirements. Under no circumstances will OSM's presence take the place of the Contractor's required QC procedures.

3. Submittal Requirements. The SMR highlights the required submittals along with OSM's timelines for submittal and review. For example, the SMR discusses the requirement to submit a WQCP for each structural steel fabricator and the time allowed for review of the entire WQCP and subsequent amendments.

4. Required Meetings and Audits. The SMR identifies meetings and audits required prior to subcontractors commencing work. For example, the SMR discusses the requirement of pre-weld meetings for each structural steel fabricator and the associated audits if required by the contract documents.

- **Fabricator Audits**

The SMR coordinates with the Quality Assessment and Management (QAM) Branch when fabricator audits are required. The audit determines if the fabricator has systems in place to adequately assure product quality. With receipt of the CEM-3101, the SMR checks the status of the material provider's audit. If the audit is not current, the SMR notifies the applicable Committee Chair (Steel or Concrete) and the QAM Branch Senior. The QAM Branch will then take responsibility of notifying the material provider and establishing an audit schedule.

The OSM Internet site (www.dot.ca.gov/hq/esc/Translab/smb.htm) contains checklists for the audits OSM conducts.

- **Prefabrication Meetings**

The SMR conducts pre-fabrication meetings with the SR, Contractor, Quality Control Manager (QCM), fabricators, and others as applicable, to discuss the requirements for releasing material. The SMR dedicates significant amounts of time to conducting and facilitating meetings with Construction. These meetings are crucial for the SMR – the single point of contact for OSM – to remain informed of relevant Construction activities.

The SMR uses previously developed meeting agendas to ensure all pertinent items are discussed and documented. The agendas, with appropriate notes by the SMR, serve as the minutes of the meeting. The SMR dictates the roles and responsibilities to all involved in the inspection process. The SMR also ensures that all in attendance understand the requirements for the submittal of Quality Control Plans and the completion of required audits. At a minimum, the SMR conducts the following meetings as applicable:

1. Pre-Weld Meeting
2. Pre-Precast Meeting
3. Pre-Bolt Meeting

- **Reviews During Construction**

The SMR is actively involved in reviewing Quality Control Plans. The Contractor submits a QCP for each fabrication shop (steel or pre-cast concrete) and for each field-welding subcontractor. Working with the SMR, the Branch Senior assigns the review to a qualified inspector. The SMR also reviews the QCP and all addenda in accordance with this manual. OSM completes QCP reviews in less than ten days, and amendments within three days of receipt.

OSM frequently receives shop plans for review. The SMR, other engineers and inspectors within OSM may perform the reviews. Coordinating with the SMR, the Branch Senior assigns the review to qualified personnel. Section 1 of this manual provides general guidelines for the shop plan review process and the content of the OSM review. The SMR contacts the designer, RE and SR to discuss the required timelines. The SMR summarizes OSM's comments and recommendations and prepares a report to the unit or person requesting the review

- **Non-Conformance Reports (NCR) and Recommendations**

The SMR provides, clear, effective, and timely materials engineering recommendations to Construction. Within three days after filing a NCR or receiving the Contractor's proposal to correct a problem, the SMR provides Construction with a materials engineering recommendation.

The SMR does not offer a materials engineering recommendation prior to receiving the Contractor's proposal to correct a problem. If the Contractor does not submit a proposal to OSM, it is appropriate for the SMR to prepare a draft letter for the RE formally requesting a response to the NCR and a proposal to correct the problem. When preparing the draft letter for the RE, the SMR uses one of the following formats:

1. Inform the Contractor of the NCR and request a response by a specific date.
2. Inform the Contractor that material will be rejected if a response is not received by a specified date (typically two weeks).
3. Inform the Contractor that the material is rejected until a satisfactory proposal is received.

Contract administration and the severity of the issue determine the type of letter the SMR prepares. The SMR consults with the Branch Senior for assistance and review of all correspondence prepared for Construction.

After receiving the Contractor's proposal, the SMR develops a materials engineering recommendation, stating if the material is suitable for its intended purpose. The SMR utilizes the following decision making process when developing a recommendation:

1. What is the benefit to the State?
2. What are the engineering consequences?
3. Are there impacts to scope, cost and schedule?

Responses to the above questions require varying degrees of research. The SMR always discusses the issue with the RE and SR. If the recommendation requires design input, the SMR consults with the Engineers who stamped the plans and special provisions. If the recommendation requires further discussions with a consultant designer, the SMR contacts the oversight engineer for approval. Other resources for the SMR include design technical committees, design specialists, and internal resources. The SMR is solely responsible for providing materials engineering recommendations.

After conducting sufficient research to make a recommendation, the SMR creates a SMR Report. The SMR Report includes the headings of Subject, Background, Discussion, and Recommendation. The SMR addresses the three questions above by documenting all conversations in the SMR Report that justify the materials engineering recommendation. The report clearly states whether or not:

1. The material meets contract requirements.
2. The material is suitable for its intended purpose.
3. A contract change order or administrative deduction is recommended.

Before forwarding the SMR Report to Construction, the SMR prepares a transmittal memo for the Branch Senior to sign. SMR Reports require approval from the Branch Senior.

- **Source Inspection Activity Management**

While remaining externally focused on Construction, the SMR also focuses internally on source inspection. In general terms, the Branch Senior assigns and supervises inspection and testing staff necessary to fulfill the SMR forecasts and the daily inspection requests. This staff completes appropriate inspections and testing and prepares the required documentation. After reviewing the documentation, the Inspector provides a copy for the designated SMR. The SMR works cooperatively with Inspectors to resolve any questions on the contract documents as well as questions on standards for inspection or testing.

As the single point of contact to Construction, the SMR has a regular, physical presence at job, fabrication and manufacturing sites, as well as at meetings. The SMR's physical presence and proactive approach result in the ability to identify potential problems as soon as possible.

The SMR reviews all CEM-3101s received for the contract. The receipt of CEM-3101s is one indicator that a Contractor is complying with contract documents. OSM may never receive CEM-3101s for some small contracts, indicating that the RE may be accepting all materials at the job site. In this case, the RE should be contacted and SMR assistance extended. The SMR tracks the number of on-going contracts in the assigned geographic area against the number of contracts for which OSM has received CEM-3101s. As appropriate, the SMR notifies the RE of problems and modifies earlier resource requirement projections based on the number and type of CEM-3101s. Additionally, the SMR informs the Branch Chief of any proposed changes to source inspection resources. Constant communication between the SMR and Branch Chief ensures successful completion of a contract's source inspection requirements.

The SMR monitors and manages how OSM notifies vendors identified in CEM-3101s. OSM Branch administrative staff processes responses to vendors, but not without prior approval from the SMR. The OSM Intranet site (http://onramp.dot.ca.gov/hq/esc/mets/structure_materials/index.shtml) lists the items that OSM inspects.

The SMR requests authorization for Out of State Travel (OST). By inspecting CEM-3101s, the SMR can identify any staff OST requirements. At least two OSM representatives are required for out-of-country work and one for out-of-state. The SMR submits necessary requests for OST with sufficient lead-time as defined in METS Directive 01 for OST. The SMR monitors OST and requests additional OST for each fiscal year as needed. The SMR works with the Branch Senior to ensure the required paperwork is submitted. Generally, the SMR submits a request for OST required for the next fiscal year (July to June) at the beginning of March. With this estimate, management develops the "Travel Blanket," a budgetary tool for prioritizing OST trips. Source inspection trips generally receive the highest priority. The SMR makes specific trip requests through the Branch Senior.

1.7.2.2(3) Contract Completion

The SMR follows the job closeout procedures outlined in Section 1 of this manual. This process begins with the receipt of the "Contract Acceptance Form," DC-CEM-6301 from the

Office Engineer. The SMR ensures OSM receives a copy of this form. The SMR compiles a list of all unresolved NCRs in a report to the RE.

1.7.2.3 Other Roles and Responsibilities as Required

In addition to fulfilling contract related duties, the SMR has responsibilities outside of individual contracts. For example, the SMR stays informed of significant changes to materials engineering or testing practice and procedures, including revisions to California Test Methods, specifications, Department organization and SMR responsibilities. The SMR also:

1. Participates in monthly meetings with the Branch Senior and Inspectors.
2. Gives presentations to Construction offices at least every two years.
3. Identifies Department procedures that need improvement.
4. Provides Branch Senior with input for monthly Branch Report.
5. Submits recommendations for improvements to OSMPP.
6. Sits on committees.
7. Performs inspections as necessary.

1.7.3 Inspectors

While Inspectors are assigned to either the field or the office, most inspectors are assigned to field duty. Field duties include performing inspections and documenting the results in the required reports.

The Branch Senior assigns one or two inspectors to the office for a set period of time. Inspectors assigned to the office are typically at the Associate Steel Inspector Level. Office duty includes drafting a daily dispatch schedule of Inspectors to the field, and then seeking the Branch Senior's approval. Other office duties may include:

- Serving on technical committees
- Web site support
- Development of new inspection forms
- Development of standards for inspection procedures
- Providing input on material management
- Performing QCP reviews
- Performing Shop Plan reviews
- Performing submittal reviews
- Peer reviewing Inspection Reports
- Training others in inspecting materials and writing reports

All inspectors recommend changes to the OSMPP as appropriate, and submit data to the Branch Senior for the monthly report.

1.7.4 Administrative Assistants

Each Administrative Assistant is responsible for the following:

- Follow procedures detailed in Appendix A
- File reports and paperwork in accordance with Section 1.16 of this chapter
- Follow procedures for project closeout in accordance with Section 1.17 of this chapter
- Complete other duties as assigned by the Branch Senior

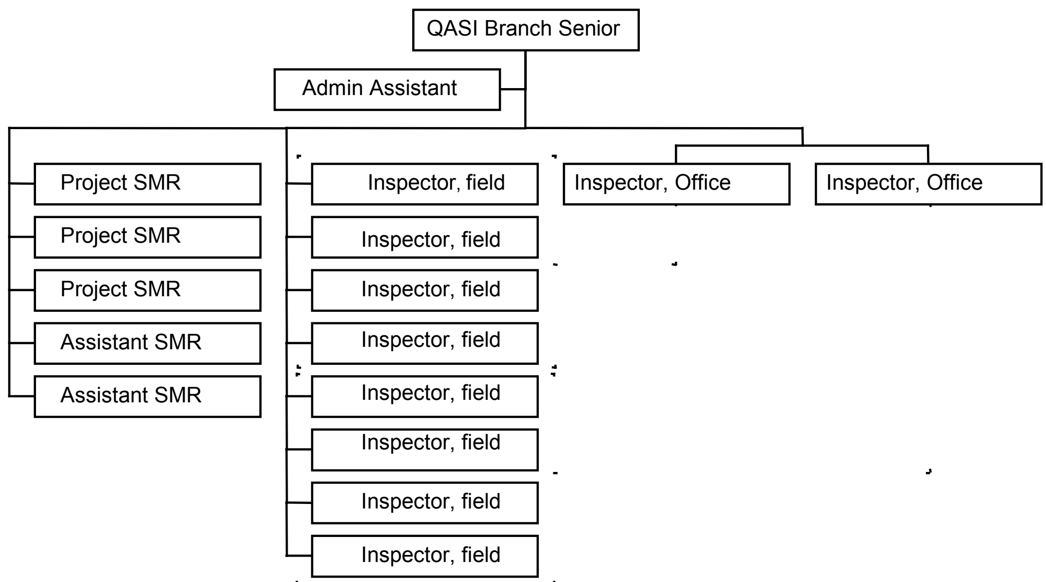

Figure 1-4 QASI Branch Organization Chart

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1.8 RESPONSIBILITIES OF THE QA INSPECTOR

The Source Inspector should bear in mind that the main reason for source inspection is Quality Assurance (QA). QA Inspection is not a substitute for the Contractor's Quality Control (QC). Quality Control is the responsibility of the Contractor and his subcontractors. For the most part, QA Inspections will be performed at random and to the extent necessary to verify that the manufacturer is substantially in conformance with the specification requirements. QA Inspection will consist of random visual inspections and check sampling of materials used to produce the final product. A primary responsibility of our Source Inspector will be to ensure that the Contractor's materials suppliers are fulfilling their quality control plan. For many materials an approved quality control plan (QCP) is specifically required to be submitted in writing for approval by the Source Inspector, representing the Resident Engineer. For purposes of this manual, whenever Inspector is mentioned, it shall be the Source Inspector representing the State.

1.8.1 Responsibilities

The primary function of the inspector is to ensure material meets contract requirements. They are responsible for the QA inspection of materials to determine reasonable compliance with plans and specifications. The Inspector is authorized to complete a non-conformance report for material that does not comply with contract requirements, and is also responsible for releasing materials that do comply. Material approved that later proves defective or unsuitable for the work contemplated can be rejected by the Resident Engineer. Section 5 "Control of Work" of the Standard Specifications clearly defines the Engineer as the final authority in the acceptance of Materials. In order to avoid impacting the construction schedule, which ultimately may result in large delay claims to the State, the Source Inspector needs to carefully and thoroughly study the specifications and plans before performing QA inspections prior to approving and releasing the shipment of any material. Inspectors shall not reinspect material that had previously been Orange Tagged unless specifically instructed by his/her lead inspector

While it is the policy of the Department to avoid unnecessary delays to the Contractor, the Inspector must not be intimidated into accepting and releasing unacceptable material. Test reports submitted by the supplier must be traceable to the furnished material and test results carefully reviewed for specification compliance. Any quality assurance check sampling and testing must be completed before release. Inspections must be conducted in an expeditious manner so as to avoid construction delays. Every effort should be made to avoid legitimate complaints that our inspections have delayed the schedule of the Contractor's work. If materials are to be rejected, the Inspector must be positive that they are enforcing the correct specification and is properly interpreting it before passing final judgement. The Inspector will immediately inform his/her Lead Inspector and the designated SMR whenever there are large quantities of materials being rejected in order that the Resident Engineer can be forewarned of possible job delay due to material rejection.

The Inspector will not allow deviations from specifications, contract plans, or approved working drawings without proper authorization, which is confirmed by his/her Lead Inspector. Deviations must be authorized by the Resident Engineer and will generally be confirmed by a copy of a contract change order or other written authorization. Assurances from a fabricator, verbal instructions from a designer, etc. are not acceptable authority unless confirmed through the Inspector's Lead Inspector.

The Inspector performs quality assurance inspections in support of the Engineer. All matters relating to contract administration are the responsibility of the Engineer. All questions relating to contract administration issues (such as controversies of interpretation of plans and specifications, policies of payments of materials on hand, requests for deviations from contract requirements, etc.) must be directed to the Engineer for official response. The Inspector has no authority to allow changes in contract requirements.

The Inspector should bear in mind that OSMPP provides only general inspection guidelines that are based on inspection policies and current specifications and plans at the time of its writing. Specifications and contract plan requirements are continually being changed and often modified for specific contract needs. Therefore, the specification references to certain numbered specifications or test methods found in this manual should always be verified by referring to the contract documents of the project for which materials are being inspected. The contract special provisions and plans will always supersede any references in these inspection guidelines. The Inspector must research the specifications and plans of each contract which they are assigned to perform inspections. It is unsafe to assume that they are the same as the last inspection.

1.8.2 Inspector Qualifications

Various classifications are utilized to perform source inspection. Lead Inspectors will assign Inspectors work that falls within the minimum qualifications of his/her classification. The Inspector should always be familiar with the end use of the material being inspected. Such knowledge will aid in performing the inspection. Studying the contract plans, approved working drawings, discussions with more experienced Inspectors, and undertaking all available training will help to promote the Inspector’s knowledge and understanding of the end use of most highway and bridge materials.

In order to perform source inspections, the Inspector must have a thorough knowledge of the work and materials under consideration. Difficult and unusual problems encountered during the progress of the work, treatment of which appears to be beyond the range of the Inspector's experience or authority, must be referred to the Lead Inspector for advice. Information or training, as may be needed, will be provided the Inspector to further his/her knowledge and expertise.

1.8.3 Personal Conduct

The Inspector represents the Resident Engineer (Section 6 “Control of Materials” Standard Specifications), and more importantly the State of California. Each Inspector, as well as all Department employees, needs to set a positive example of public service and good citizenship by following both the letter and the spirit of laws, rules and policies governing Caltrans. Each Inspector, as well as all Office of Structural Materials staff, must comply with the policies of the

Office and the Department. Each Inspector shall review these directives, policies, and internal memoranda. The Branch Senior shall ensure that the current issues of such documents are made available to their subordinates. All of the Department's Directives and Policies governing personal conduct and behavior will be read, understood, and followed in the performance of the Inspector's duties.

1.8.4 Safety Regulations

Inspection activities shall be conducted in accordance with the Department's Health and Safety Manual. Whenever, the requirements of the supplier's workplace require more stringent requirements than are listed in the Department's manual, the Inspector shall comply with the requirements of the workplace where inspections are to be performed.

As a minimum, the Inspector must always wear an orange safety vest and safety hat. Safety toe shoes, when required by the work place, must be worn. Inspectors working in the area of welding and grinding operations must wear eye protection and safety to protect their eyes from weld flashing and foreign objects. Ears shall be protected from excessive noise. When working over water, the Inspector shall always wear proper flotation vests. A safety rope or lanyard shall be used when working at heights above ground level.

The Department will supply all needed safety attire and equipment. It is the responsibility of the Inspector to request these from the Lead Inspector before performing inspection. It is the Lead Inspector's responsibility to ensure that all safety equipment and instructions in their proper use are provided the Inspector. Safety training, when deemed necessary, will be provided the Inspector. Inspectors who work near radiographic testing of welds shall be properly trained to protect themselves from radiation hazards. Extra precautions shall be used when working in the vicinity of hazardous materials. Inspections shall not be performed whenever unsafe conditions exist. The Contractor shall be notified that inspections will not be performed until unsafe conditions are corrected. The Inspector's Lead Inspector must be alerted when the Inspector is assigned to an unsafe work place.

The attachment of inspection release tags and the marking of the Inspector's Lot Numbers must be personally done by the Inspector or by the supplier under the Inspector's personal supervision. The Inspector must not jeopardize his/her safety when releasing materials. If materials cannot be tagged or marked safely, require the supplier to move the materials into a safe position or location before proceeding.

1.8.5 Reports

Documentation of the QA Inspection Process is one of most important functions in the overall inspection process. As described above, Inspectors must complete inspection reports for each inspection call. All reports will be concise, complete, and submitted promptly for the Lead Inspector's review. Inspectors should complete the inspection reports on the same day of the inspection and in no case complete the report later than 24 hours after leaving the inspection site. An inspection is not complete until the required paperwork is submitted for review and processing.

OSM Reports shall be transmitted or forwarded to the individuals and entities identified in Appendix A.

The most up to date forms can be downloaded at the following OSM Internet site:

http://www.dot.ca.gov/hq/esc/Translab/smbforms.htm

1.8.5.1 Daily Inspection Report Requirements

Inspectors will complete one of following inspection reports for each inspection visit when a TL-29, TL-6011, or TL-6012 is not completed:

TL-6031, "Welding Inspection Report":
An inspector will complete a TL-6031 at an inspection site where any type of welding is performed on the bid item being inspected.

TL-6033, "Concrete Inspection Report":
An inspector will complete a TL-6033 at an inspection site where any type of concrete product is being inspected

TL-6034, "Source Inspection Report":
An inspector will complete a TL-6034 for all other types of material. Inspectors will include lot numbers and quantity of material released in the TL-6034 if any material was released.

1.8.5.2 Lot Numbers

If material conforms to contract requirements, inspectors will assign an individual Lot Number to each lot or shipment. This Lot Number will serve as identification for a particular shipment from origin to final destination and will be used in the Resident Engineer's final report to record satisfactory acceptance of the material. Inspectors may also assign lot numbers to inspection reports, supporting documentation or submittals as necessary.

OSM uses a pre-defined Lot Numbering System in order to identify the originating OSM branch, the inspector performing the inspection, and the calendar year in which the inspection was performed. The lot number is a unique identification number used to track and control all material OSM determines to meet contract requirements.

There are three components to a lot number:

1		2		3
Branch Prefix	-	Identification #	-	Calendar Year

1.) Branch Prefix:

Sacramento	S
Los Angeles	L
Bay Area	B

2.) Inspector Identification Number:
The inspector identification number is a five-digit number that resets on January 1 of each year. Each OSM branch assigns a two-digit identification number to inspectors. The number can range from 01 – 99. The inspector then adds a three-digit number ranging from 001 – 999 for each material release completed.

3) Calendar Year:
The calendar is the last two digits of the calendar year.

Example: The Emeryville OSM Branch assigns Inspector Jones an identification number of 14. On January 1, 2003, Inspector Jones determines material conforms to contract requirements and completes his first material release. He assigns the following lot number to the shipment of materials:

B 14-001-03

1.8.5.3 Inspection Reports

TL-29, "Report of Inspection of Materials":
Inspectors will complete a TL-29 if the responsibility for the material is transferred to construction staff and it or its parent material no longer requires METS inspection. These materials typically have been through all manufacturing and fabrication processes. They are typically finished products and ready for use. Inspectors will assign a lot number to the Inspection Release, TL-0624 (Orange Tag) and TL-29. Inspectors will attach a sufficient number of Orange Tags to each shipment for easy retrieval and identification by the Resident Engineer. The Lot Number will also be legibly marked on the shipping container or directly on the product if tags are not feasible or cannot be securely attached. Attachment of Orange Tags or the marking of the Lot Numbers will be PERSONALLY performed by the Inspector or conducted under the personal supervision of the Inspector. Tags will not be left with the supplier for later attachment at his own discretion. The Inspector shall initial and date each tag. Lot Numbers, dates, and Inspector's initials shall be

applied with permanent and waterproof ink. Inspectors are not required to complete one of the above inspection reports when completing a TL-29, so long as all QA inspection activity for that day is documented on the TL-29, "Report of Inspection of Materials."

It is important to note that when the Engineer receives materials with tags, he/she assumes it has been inspected and can be incorporated into the work. Inspectors will not Orange Tag material until all inspections and test have been performed. In cases where the RE or SR accepts responsibility for completing the inspection, the METS inspector will document what needs to be completed on a TL-29 and orange tag the material to the jobsite. In these instances, the inspector shall ensure the following is annotated on the TL-29: "This material requires further modification of fabrication prior to incorp9oration into the final work. The Resident Engineer or Structure Representative has agreed to accept responsibility for subsequent inspection."

The following guidelines shall be followed when determining the use of an Orange or Green Tag for material release.

- Material shall be Orange Tagged if the responsibility for the material is transferred to construction staff (i.e. rebar or strand for cast in place concrete, piling to be field welded after driving, etc.
- Material shall be Orange Tagged if it or its parent material no longer requires METS inspection.
- Material shall be Green Tagged if it is being shipped from one vendor to another vendor where METS is still responsible for inspection (i.e. strand or rebar going to a pre-cast yard.)
- Material may be Green Tagged to the jobsite if additional METS inspection needs to occur (i.e. structural steel sent to a field welding operation at or near the jobsite.)

<u>TL-6011, "Component Material Inspection Report":</u>
Inspectors will complete a TL-6011 for material that has been inspected and tested and complies with contract specifications at that point in the fabrication process. This material is typically shipped to another plant under inspection control of the Office of Structural Materials. For this type of release, Inspectors use a Green Tag labeled Caltrans Stock No..________.". Like Orange Tags, Inspectors assign a Lot Number to the material and annotate it on the Green Tag. Inspectors shall apply a Green Tag to material being shipped from one vendor to another where METS is still responsible for inspection. Inspectors include sufficient details in the TL-6011 to document the applicable specifications the material was inspected. For steel products, inspectors will indicate that steel is **foreign** by marking back of tags with the word **"FOREIGN."** Inspectors are not required to complete one of the above inspection reports when completing a TL-6011, so long as all QA inspection activity for that day is documented on the TL-6011, "Component Material Inspection Report."

Material may be shipped to the jobsite if additional METS inspection needs to occur. The SMR should be consulted when applying a Green Tag in these instances. The SMR shall notify the Resident Engineer or Structure Representative that an inspection will need to be requested if they desire additional METS support.

<u>TL-6012, "Report of Inspection of Stock Material":</u>
Subject to the approval of the Office of Structural Materials, a fabricator or vendor who agrees to reserve the major portion of a large lot of material for State use may arrange to set up a pre-tested stock lot. Under this arrangement the Inspector will sample, test, and identify it as State-tested stock if the material passes all required tests. Stock materials will be identified by attaching "Green Tags"**,** or by permanently marking the Lot Number on the material. Marking of Green Tags shall conform to the same marking requirements for the Inspection Release Tag (Form MR-0624). Stock material must be safely stored so as not to be deteriorated by the weather. Inspectors will complete a TL-6012, "Report of Inspection of Stock Material," when "STOCK" material is green tagged. Inspectors are not required to complete one of the above inspection reports when completing a TL-6012. Since "STOCK" material is not specifically for any one job or EA, the TL-6012s will be filed by the inspecting branch under the name of the manufacturer or fabricator.

Shipments may be released from Green Tag stock to other State projects without further testing. The vendor is required to maintain an inventory record that will record the shipments made to state contracts and a running balance of the remaining inventory. When material is released from such pre-approved stock, the Inspector will note the Lot Number on the Inspection Shipping List to indicate the material was pre-approved and check sampling was waived.

Materials tested as stock will normally be tested for compliance with the current Standard Specifications. It will not necessarily comply with the special provisions for a given contract, which may have a special requirement. It is the responsibility of the Inspector to check the special provisions to ensure that pre-approved stock complies with the specifications for the specific contract to which the material is released. This is especially important during the transition period between old and new Standard Specifications. For steel products, indicate that steel is foreign by marking back of tags with the word **"FOREIGN**
The use of Green Tags for pre-approved stock and the release of partially fabricated products provide mutual benefits to both the State and the supplier. By sampling and testing for stock the number of check samples and required tests are considerably reduced. This results in economies to both the State and supplier and aids in expediting the release of materials to State projects. Additionally, it provides a system of tracking the fabrication progress of materials moving from one location to another.

<u>TL-6032, Welding Witness Report:</u>
Inspectors will complete a TL-6032 when Welder Qualification Procedures or Welding Procedure Specifications are witnessed or observed. The completion of a TL-6032 does not exempt an inspector from completing a Source Inspection Report, TL-6034 or Welding Inspection Report TL-6031.

<u>TL-6037, "Weekly Fabrication Report":</u>
Inspectors will complete a TL-6037 for most plant fabricated materials requiring continuous shop inspection, such as structural steel, pre-cast or pre-stressed concrete, and steel sign. The report will list the raw materials on hand, percentage of completion, the quantities approved for shipment, and

the quantity shipped to date. Significant delays or material rejections must be listed under remarks. These reports must be accurate and submitted promptly, as they are used for verification for payment of materials on hand by the Resident Engineer.

TL-15, "Quality Assurance Nonconformance Report":
Nonconformance reports (NCRs) are an integral component of OSM's quality assurance inspection process. They are utilized to communicate to Resident Engineers (REs) when OSM personnel discover structural material or Quality Control (QC) procedures that do not meet the specific contract requirements. The fundamental objective of Quality Assurance (QA) is to inspect contractors' QC personnel and procedures. The purpose of NCRs is not to reject material. These reports merely identify material, at the time the report is written, that does not meet the contract requirements. NCRs also identify examples of when the contractor's QC personnel or procedures are not functioning properly. The RE will make the final decision regarding the incorporation of the material into the project.

Inspectors will write an NCR under the following circumstances:

Quality Assurance (QA) inspection identifies material that does not meet contract requirements, and the contractor's quality control (QC) personnel have already accepted the material. An NCR is not required on the first or second occurrence of a deficiency if QC personnel acknowledge the problem and ensure it is corrected within a work shift. The inspector will document the deficiency and the conversation with QC personnel in the inspection report. The QA inspector must verify any correction before releasing any material. The following bullets clarify these procedures:

a. A QA Inspector will write an NCR for the material if the contractor cannot correct the deficiency within a work shift.
b. A QA Inspector will write an NCR on the Quality Control on the third occurrence of the deficiency regardless of the contractor's ability to correct the problem within a work shift.

2. A QA Inspector will typically not write an NCR on material that will be corrected within a work shift..

3. QA inspection reveals obvious attempts to hide processes or products that do not meet the contract requirements.

4. Contractor ships material without a METS/OSM release tag.

Inspectors will write an NCR on the Quality Control under the following circumstances:

1. The third occurrence of the same deficiency regardless of the contractor's ability to correct the problem within a work shift (repeated from above).

2. Any nonconforming item that is a repeat of a previous item that resulted in an NCR.

3. Any action taken by QC that is not in conformance with the contract requirements or any attempts to hide nonconforming items.

Inspectors will typically not write an NCR on Material under the following circumstances:

1. Material that has not been inspected and accepted by the contractor's QC personnel.

2. Material that can be repaired or fixed within a work shift of when the deficiency is discovered (an NCR may be required on the QC, see procedures outline above).

3. Material that has been identified by QC that does not meet the contract requirements and can be repaired during production. (This conversation and action will be noted in the inspection report by the QA inspector).

4. Rejectable discontinuities found through nondestructive testing by QA in areas not tested by QC and repairs are commenced promptly (this conversation and action should be noted in the inspection report by the QA inspector).

Inspectors will ensure the following procedures are met when dealing with NCRs:

1. The inspector locates a problem or deficiency and informs QC and/or a responsible representative from the contractor of the issue. QA inspectors are not authorized to stop work. Inspectors will identify to the contractor areas of nonconformance; however, NCRs will not be provided to the contractor or quality control personnel.

NOTE: The QA inspector will not stop work under any circumstances unless specifically authorized by the Branch Senior or Resident Engineer.

2. The inspector contacts his Lead Inspector to discuss issue.

3. Lead Inspector agrees that an NCR is required.

4. Lead Inspector informs the SMR of the NCR.

5. SMR notifies Resident Engineer and Structure Representative of the NCR. Verbal notification to the RE or SR should be complete within 60 minutes of the identification of the non-conformance.

6. Inspector drafts NCR and submits to Lead Inspector for review.

7. Lead forwards NCR to SMR for distribution to Structure Representative and Resident Engineer.

An illustration of both the verbal notification and written notification process of NCRs are shown below in Figures 1-5 and 1-6.

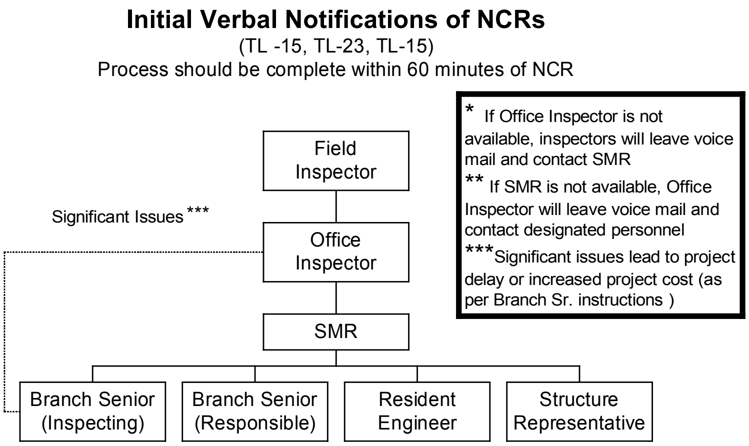

Figure 1-5. Initial Verbal Notification of NCRs.

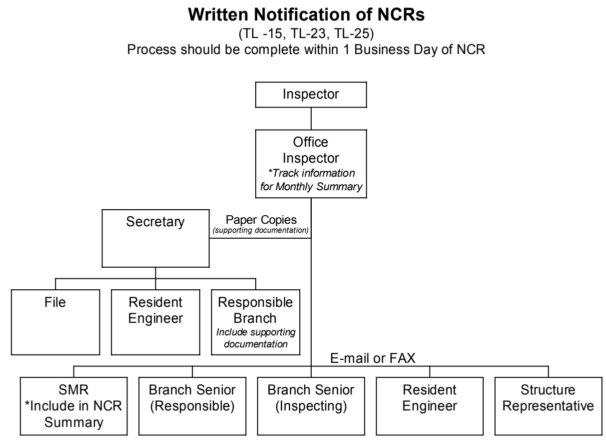

Figure 1-6. Written Notification of NCRs.

For any issue that does not clearly meet one of the criteria 1 through 3 above, the SMR will discuss the issue with the OSM Branch Senior to determine whether an NCR shall be written. Once an NCR is produced, the SMR is responsible for notifying the RE within 60 minutes, preferably in person or by phone. The NCR document shall be produced, reviewed and faxed to the RE within 24 hours of the determination that a nonconformance report needs to be written.

TL-16, "Quality Assurance Nonconformance Resolution":
An inspector or SMR will complete a TL-16 when the Resident Engineer approves a proposed course of action. The designated SMR will track the number of outstanding NCRs and work with the Resident Engineers and Structure Reps to reach a resolution. SMRs are responsible for acquiring signed correspondence from the RE or Structure Representative (SR). If the SMR and RE or SR reached a resolution during a telephone conversation, the SMR will attempt to get a response by electronic mail with an e-mail documenting the conversation.

TL-649, "Verification of Materials on Hand":
The Standard Specifications provide that certain materials listed in the special provisions may be paid for as materials on hand. To be eligible for progress payment the materials must be stored in California, unless otherwise permitted by the special provisions or Resident Engineer. The Resident Engineer relies on the Source Inspector to verify both the quantity and acceptability of materials stored off the job site. The verification procedures are listed in the Construction Manual. (http://www.dot.ca.gov/hq/construc/manual2001/#chapter1). Verification is accomplished as follows:

1. The Request for Payment (Form TL-0054) is sent by the Contractor to the Resident Engineer. The Resident Engineer forwards a copy to the Office of Structural Materials.

2. The Inspector checks the material for acceptability, proper storage, and quantity. Unless otherwise directed by the head of the Office of Structural Materials, the following requirements must be met:

   a. The material must be listed in the special provisions as eligible for partial payment.
   b. The material must comply with the specifications.
   c. Unless there are instructions to the contrary, it must be stored separately from other like materials, and identified as State property and marked with the contract number. It must be stored in such a manner so it will not deteriorate or be damaged by weather.
   d. Except when otherwise noted in current instructions, the fabrication should be complete and the material ready for shipment. Raw structural steel and prestressing strand may be paid for even though not in a completed state.

   The checking for quantity should be done as directed by the Lead Inspector. Usually, purchase orders, invoices, receiving records and similar documents are employed together with visual counts or estimates to make a reasonably accurate estimate of material on hand.

3. The Inspector reports his findings to the Resident Engineer on Form TL-649, Verification of Materials on Hand. Quantities and acceptability of materials are noted. Discrepancies, unsatisfactory or questionable conditions should be noted, and the Resident Engineer notified by telephone in the event of serious discrepancies, particularly if the report is close to the monthly deadline, normally the 20th of each month. The Inspector must expedite replies to any requests for verification of payment of materials on hand. For structural steel, precast prestressed concrete members, and steel sign structures, the Weekly Progress Report, Form TL-6037, will be the verification document in lieu of Form TL-649. It is important to remember that unsatisfactory condition or storage should be noted on this form, otherwise it will be assumed that payment is in order. A confirming Form TL-649 will be issued monthly until all material is shipped. The remaining balance of materials on hand is to be reported if partial shipments have been made from the quantities for which payment has been requested.

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1.9 QUALITY CONTROL PLAN REVIEW

1.9.1 General

The purpose of this section is to discuss the required items to be included in the quality control plan (QCP) for welding and pre-cast concrete. The designated SMR is responsible for ensuring each Quality Control Plan is reviewed in the timelines set forth in the contact requirements.

1.9.2 Welding Quality Control Plan (WQCP)

The Welding Quality Control Plan (WQCP) is an important document that needs to be submitted to OSM prior to commencing any welding. The WQCP is important because it provides assurance that the contractor has read and understands the contract documents. In addition, without an approved QCP, OSM inspectors do not know all of the inspection requirements.

After receiving the WQCP from the contractor, the RE's office normally submits the WQCP to OSM for review. OSM typically has ten days to review the WQCP package, and three days for subsequent addenda. Upon completion of the review, OSM provides the RE's office with its recommendations. Finally, the RE's office will write a letter to the contractor based on OSM's recommendations.

The following forms are used during the review of the QCP submitted to OSM. They identify the use and intent of all the above mentioned items and forms. Samples of these forms are included in Appendix B.

<u>TL-23, "Review of Contractor's Welding QCP":</u>
Inspectors will complete a TL-23 to document the review of all contractors' Welding Quality Control Plan submittals. The reviews will be based on the governing AWS code and contract specifications. Inspectors will document all nonconforming items on a TL-23.

<u>TL-25, "Review of Contractor's Welding FCP":</u>
Inspectors will complete a TL-25 to document the review of all contractors' Welding Fracture Control Plan submittals. Inspectors will document all nonconforming items on a TL-25.

<u>TL-27, "Review of Contractor's WPS / PQR Submittal":</u>
Inspectors will complete a TL-27 to document the review of all contractor Welding Procedure Specifications and Procedure Qualification Record submittals

1.9.3 Precast Concrete Quality Control Plan (PCQCP)

Precast concrete Quality Control Plan (PCQCP) is an important document that needs to be submitted to OSM prior to commencing any concrete pours. Precast concrete quality control shall conform to the requirements in Section 51, "Concrete Structures," of the Standard Specifications, and these special provisions. The QCP is important because it provides assurance that the contractor has read and understands the contract documents. Precast concrete quality control shall apply when any concrete is precast in conformance with "Concrete Structures," of the special provisions and the following items as shown on the plans:

- Precast concrete segments
- Precast lightweight concrete panels
- Precast concrete walls for footings
- Precast concrete fender modules for fender systems

Precast concrete quality control shall include the following items that are conducted in the sequence listed:

- General precasting meeting
- Contractor performs precast concrete facility audit
- Caltrans performs precast concrete facility audit
- Contractor submits Precast Concrete Quality Control Plan (PCQCP)
- Engineer reviews PCQCP
- Contractor performs ongoing quality control during all precasting and related operations

PCQCP shall include the following:

1. The name of the precasting firms, the concrete plants to be used, and the concrete testing firm to be used.

2. A manual prepared by the precasting firm that shall include equipment, testing procedures, safety plan, and the names, qualifications and documentation of certifications for all personnel to be used.

3. Thenames, qualifications and documentation of certifications for the QCM and all QC Inspectors to be used.

4. An organizational chart showing all QC personnel and their assigned QC responsibilities.

5. Details and schedules for the training program for the QCM and all staffperforming precasting operations and precast QC.

6. The methods and frequencies for performing all required quality control procedures, including all visual inspections, material testing, and survey procedures for all components of the precast elements including the following:

   - Prestressing systems
   - Concrete
   - Grout
   - Reinforcement
   - Steel
   - Miscellaneous metal
   - Formwork

7. A system for the identification and tracking of all precast elements.

8. A system for identifications and tracking of required precast element repairs, and a procedure for the re-inspection of any repaired precast element. The system shall have provisions for a method of reporting nonconforming precast elements to the Engineer.

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1.10 SHOP PLAN REVIEW

1.10.1 Roles and Responsibilities

The SMR is responsible for ensuring the OSM shop plan reviews meet the expectations of the designer, the RE and SR while providing comments that are consistent among OSM Branches. Typically, the Office of Structures Design or the Consultant Contract Management Branch (CCMB) will provide OSM with structural steel shop plans for review. However, some large or unique projects, such as the projects within the toll program, may be coordinated under the direct control of the RE. In some cases, OSM will be requested to perform shop plan reviews for work other than structural steel (such as prestressed/precast concrete). These cases are determined on a project to project basis.

This chapter provides general guidelines for the shop plan review process and the content of the OSM review. However, the SMR must ensure all individuals involved have the same expectations before the shop plan review process begins. It is recommended that the SMR meet with the designer, the RE and SR to verify the expected content of reviews and the document control process. The SMR shall document these expectations and provide the summary to all individuals involved. The SMR, engineers and/or inspectors within OSM may perform the reviews.

Section 55-1.02 of the SS states that the time for shop plan review by Caltrans and correction by the contractor "shall be proportional to the complexity of the work, but in no case shall the time be less than six weeks for highway bridges or eight weeks for railroad bridges." The ambiguity of this statement has enabled Contractors to successfully argue in Dispute Resolution Boards that the entire review and correction process should take six weeks, regardless of the number of revisions necessary. Consequently, timeliness of the review is paramount. The review turnaround time should be addressed and agreed upon with all parties prior to commencement of the review process.

1.10.2 Review Guidance

Typical items OSM is responsible for reviewing along with some general guidance:

a. Weld details
   - Ensure the reinforcing fillet weld required for dynamic structures is shown for corner and tee-grove welds.
   - Ensure the weld detail is not prohibited by the contract documents. For example, a V-groove may be prohibited for pile splices performed in the horizontal position. Each contract may have its own specific limitations regarding weld details.
   - Determine if the weld detail is not a prequalified detail. Although this is not reason for rejection, a comment should be provided to the contractor that any detail that is not prequalified must be specifically qualified by a procedure qualification test in accordance with the project specifications.

b. NDT requirements
   - Ensure the contractor includes notes providing the NDT schedule, and that its meets the contract requirements. These notes may be included in the tail of the weld detail, but may also be included as general notes on the applicable shop plan pages.
   - Precast/prestressed
   - Forms are constructed in a manner to eliminate possibilities for concrete paste and fine aggregates to leak through joints during consolidation.
   - Blockouts, studs and anchors are placed in such a way as to minimize interference with reinforcement, prestressing strand, and/or post tension ducts.
   - Notes shall be included requiring epoxy coated tie wires for use in members with epoxy rebar.
   - Post tension ducts are secured properly in order to maintain proper alignment during the concrete pour without causing consolidation problems.

c. Constructability
   - This can cover many different areas, including precast/prestressed concrete, and depends largely on the experience of the reviewer to find problems. If possible, significant issues should be identified up front so the reviewer has some specific guidance of what to look for. For example, if a particular welded assembly is highly restrained, and contains many large full penetration welds, distortion and residual stresses may become a problem. The shop plans should reference a distortion control plan to limit distortion and residual stresses.

1.10.3 Execution

The SMR is responsible for briefing all OSM personnel who will be supporting the shop plan review process. These personnel include engineers and technicians who will be performing the majority of the reviews along with administrative staff responsible for receiving and forwarding documents. The brief will include all expectations, any known unique project requirements and the process for receiving shop plans and providing comments. Throughout the review process, the SMR shall perform periodic reviews of the comments provided by OSM. This review is intended to verify required issues are being addressed and consistency is being maintained among reviews. The SMR shall also ensure a complete set of approved shop plans is maintained with an accurate log.

1.11 OUT OF STATE TRAVEL

The purpose of this section is to provide the Structural Material Representative (SMR) and Lead Inspectors with guidelines, clearly establishing the roles and responsibilities for the preparation of necessary documents pertaining to all travels of Engineering Service Division personnel transacting state business at a point outside of the State of California. The responsibilities include that out-of-state (OST) approvals should be accomplished during the entire construction period of the project without impacting or delaying the delivery of materials from the fabrication shops. The procedure is applicable only to civil service employees' travel; all other personnel employed by the consultants are exempt from this procedure.

An OST request must be processed whenever state business is conducted out of the State of California including any overseas travels.

It is the responsibility of the Lead Inspector to see that all the OST request documents are submitted and approved for the projects administrated by him/her, so that the travel arrangements can be made on short notice, without delay.

The Lead Inspector shall implement the Division Directives No. DMETS-02, and assure that all the OST be identified in the approved ESC Out-of-State Travel Blanket (OSTB).

1.11.1 List of Fabrication Shops Requiring OST Based on DC-CEM-3101

The Bid Items are the main source of information for identifying the locations of fabrication shops where the prime contractor may consider, at a later stage, to fabricate the materials and require QA and Source Inspections. Based on Special Provision requirements, the SMR shall identify all the categories of materials requiring QA and Source Inspection pertaining to OST in coordination with RE office. A detailed, comprehensive list of bid items should identify the type of inspectors, qualifications of personnel performing the inspections, forecast the inspection staffing requirements of various categories of materials and duration at each fabrication facility location.

The SMR is responsible for the preparation of all documents required for forecasting the total traveling cost for each fiscal year starting from August 1 through June 30 each year. In the absence of essential data to prepare such documents, assumptions must be made to identify the number of trips required to each fabrication shop, the number of facilities for the Bid Items noted in the contract documents and cost break down for each trip with specific duration.

Upon award of the contract, the prime contractor is responsible to fill out form DC-CEM- 3101 (old HC-30) "Notice Of Material To Be Used" for each fabricator and submit it to the Resident Engineer (RE). The RE will approve and issue this form to METS. Based on the information provided in 3101, METS will issue another Form TL-608 "Notice Of Material To Be Used" to the fabricator confirming the inspection requirements.

During construction the RE may issue change orders revising the scope of work requiring fabrication of additional material which is not on the list of bid items. In this case the SMR should coordinate with RE to ensure a new DC-CEM-301 is issued to the fabricator. This change order work may require revising the original fiscal year travel cost forecast, which was previously approved.

1.11.2 Form FA-0257, Request for approval of OST travel

Once all the travel requests for the fiscal year are approved, the Lead Inspector shall complete Form FA-0257 for each trip and coordinate with Branch Senior to assure. The Lead Inspector is not responsible for the travel arrangements and any other related activities such as car rentals and hotel reservations etc.

The following activities should be implemented:

- Prepare cost estimate for the trip
- Prepare a request for OST for approval from Branch Chief

1.11.3 Procedure

The Lead Inspector is responsible for implementing all the Division Directives Number DMES-02 for "Division of Materials and Testing Services" under the title "Out-of- State Travel".

- No OST shall occur without an approved OST request
- All OST must be identified in the approved ESC Out- of-State Travel Blanket (OSTB)
- OST request shall be submitted at least six weeks in advance
- OST will not be allowed for vendor or supplier funded events

1.12 GENERAL INSPECTION INSTRUCTIONS

1.12.1 Certificates of Compliance (COC)

Section 6-1.07 of the Standard Specification specify the requirements and use of Certificates of Compliance. Such certificates are required for specific materials. The approved quality control plan required for some products may additionally require that a Certificate of Compliance be supplied. Whenever the **Buy American Act** governs steel products, the manufacturer must supply a certificate stating that all manufacturing processes used to produce the material have been performed in the U.S.A. This certification must satisfy the requirements of the special provisions. A responsible person of the manufacturer or an authorized representative must sign certificates of compliance. The quality control supervisor for major suppliers will normally sign the certificates of compliance and certified test reports.

When authorized by the specifications or allowed by Department policy, the Engineer may accept certain materials prior to sampling and testing, if accompanied by an acceptable Certificate of Compliance. Certificates of compliance should only be accepted from those sources that have prior records of proven reliability and established in-house quality control. Materials accepted on the basis of certificates of compliance may be sampled and tested at any time. The Department reserves the right to refuse the use of material on the basis of a Certificate of Compliance. This may occur if our quality assurance testing have resulted in frequent failing tests and the supplier is failing to perform satisfactory in-house quality control practices in accordance with Section 6-3.02 Testing By Contractor of the Standard Specifications.

Portland cement is one of the materials which may be accepted on the basis of a Certificate of Compliance. When cement is shipped to the jobsite, the certificate goes to the Resident Engineer, who takes check samples in accordance with the Construction Manual. (See Senior for Construction Manual). When it is used in precast products under the inspection control of the Office of Structural Materials, the inspector assigned to the plant receives the certificate from the fabricator and takes check samples of the stock cement in accordance with current instructions.

For some products, such as elastomeric bearing pads, and Type "B" joint seal, samples are obtained directly from the manufacturer and tested prior to use. A Certificate of Compliance and certified test reports are required for such materials. On the basis of the certificate (plus certified test report for some materials, materials may be accepted on the basis of partial instead of complete testing. Reduction of the number of tests will reduce our testing costs and expedite release of materials to the project. Additionally, there are certain tests which require specialized testing equipment which only the manufacturer possesses.

When certificates of compliance and accompanying test reports are received by the Inspector, they must be carefully reviewed to ensure that they are complete, accurate, and in an acceptable format. The Department will supply copies of acceptable formats to be used when requested. After reviewing these documents, the Inspector shall sign and date them. This will signify that the certificates and accompanying documents have been thoroughly reviewed and are acceptable.

1.12.2 Inspection of Materials for Outside Agencies

In addition to inspecting materials for highway contracts, Inspectors may be assigned to inspect commodities and other products for the Office of Procurement and Contracts or for other State or local agencies. These projects will not be listed in OSM internal common file. For projects with no EA listed in the common file, inspections shall not be performed unless specifically directed by the Senior of each Branch.

1.12.3 Buy American Act

For projects with Federal Funding, the "Buy America Act" usually applies. The “Buy American” requirement is stated in the special provisions for the contract, and the Inspector can verify this requirement by reviewing the special provisions. This requirement states that all manufacturing processes performed in the manufacture of ferrous materials be performed in the United States. The Domestic certification must provide such specific wording.

The minimum allowance for the use of small quantities of foreign steel may be approved by the Resident Engineer. The Inspector does not have the authority to make such approval. When foreign steel is released, note on the Report of Inspection (Form TL-0029) the items that are foreign steel with an additional note that this has been approved by the Resident Engineer. On projects that do not have any Federal financing, the “Buy America Act” does not apply unless superseded by the special provisions.

On projects with no Federal Funding, the "Buy America Act" does not apply and ferrous materials produced outside the United States may be allowed.

1.12.4 Substituted Materials

Where specifications indicate that "or equal" materials may be used, the burden of proof as to equality will remain with the vendor. Substitute materials will not be considered unless accompanied by the vendor's certificate of compliance of equivalency and supportive test reports. Suggested tests to prove a material’s equivalency must be evaluated by the Inspector’s Lead Inspector and approved by the Resident Engineer. A contract change order may be necessary to accept an equivalent material, if there is an appreciable cost advantage to the Contractor. Additional proof may be required over that offered by the vendor.

1.13 STRUCTURAL MATERIAL TESTING BRANCH

1.13.1 Introduction

The intent of this section is to meet the following goals:

- To improve the interaction between OSM Staff and the Structural Materials (SM) Materials Testing Lab.
- Reduce the direct contact from the structures construction project staff to the testing lab staff.
- Develop consistent testing information to the projects.
- Address testing result questions and problems in a timely manner, so that project delays are minimized.

1.13.2 Communications

The Division of Materials Engineering and Testing Services (METS) is located in Sacramento, many miles from most major structures construction projects. This does not allow consistent contact between OSM staff and the lab's technical staff. METS has a 185+ person staff consisting of many technical specialists on materials topics related to highways/structures construction. Timely contact with the appropriate person for technical answers can be critical to the relationship with the construction project engineers. The following gives the order of levels of information related to the appropriate process for finding the right person to contact for the question at hand.

- Engineering Services (ES) Contact List - ES publishes a list of contacts for technical consulting services at http://www.dot.ca.gov/hq/esc/techpubs/esservicedirectory.pdf. This gives the technical contacts for METS as well as other Divisions. The METS contact list can be found at http://www.dot.ca.gov/hq/esc/Translab/metscontacts.htm. Lookup the area of interest for a contact person. The contact may be in one of the Branches outside of Structural Materials Branch (SMB).
- <u>SMB Lab Staff</u> -SMB has several areas of expertise for consultation on specifications, testing, and field inspection problems. They can explain test results and give test method tolerances.
- <u>Whom the SMR should contact first</u> - The Senior Engineer level should be the first line of contact within SMB. He/She may delegate it to one of his/her staff for further detailed support. Specific work requests must go through the supervisor. He or she needs to know what their staff is working on and the work priority. In their absence, it would be appropriate to contact the lead person in the Section.

1.13.3 Tagging and Sampling procedures

In some cases, material is required to be sampled and tested prior to tagging and releasing. A TL-101 is the form used for a sample that is being sent to the OSM test lab in Sacramento. When testing is complete, a phone call from the SMB to the METS office is made to report results. The results are logged in the binder entitled "Engineering Service Center Transportation Lab Test Results Log." The inspector is then notified of the results. If the tests pass, the inspector will release the material and issue a release tag with a lot number assigned to that material. A faxed copy of the test results will soon follow the phone call and the results will be forwarded to the inspector to attach to their release package.

Although all bridge components are subject to sampling and testing, it is not always required. The Special Provisions will normally dictate which components will be sampled, but the Engineer may call for more or less sampling as he/she deems appropriate. Some factors influencing whether a material is sampled or not include: input from METS, function of the component on the bridge, and historical reliability of the Contractor or manufacturing process. When materials do not require sampling, a visual inspection is conducted as means for tagging and releasing to the job site.

1.13.4 Proper Sampling

Check the project's special provisions for information about specialized items that require a particular type or number of samples.

- Correct number of samples for required testing – The number of samples are based on project specifications, Caltrans Standard Specifications, ASTM, AASHTO, ANSI requirements. If it isn't stated, a minimum of three samples shall be tested or as noted in Section 2-309-6 of the Source Inspection Manual.
- Verify that QC results meet the specification requirements - Manufacturer's QC data must show compliance with specifications. They must be readable and understandable. The testing data must support the included Certificate of Compliance.
- Size and type sample - Some materials require specific lengths and configurations. Steel plate or bar size maybe controlled. Sample may have to come from within the component. For example: See Standard Specification Section 51-1.12H(2) Steel Reinforced Elastomeric bearing pads 2" or thicker.

1.13.5 Documentation Guidelines

- Getting the right information the first time and documenting it on the proper form makes the testing process much more efficient.
- Materials test reports - Final product test results should be in readable format. Should include what tests were done to what specific specifications.
- Mill test reports – Parent (source) materials analysis and physical test results from the metal foundry must be included with many products. These suppliers must meet ASTM specifications requirements.
- Tracking numbers from supplier - Product must be identified by some combination of the following: lot #, heat #, load #, or release #. All must be traceable back to the parent material mill test reports and certificates of compliance.

- Project information - Contract information is a must; Resident Engineer, Structures Representative, expense authorization (E.A.) or project number, the name of the person who took samples or witnessed the sampling process.
- Applicable specification - Job specifications can't be identified without bid date information. Check the SSP cover.
- Sample traceability – To have proper traceability all documents must match and the reference numbers must be carried over from one document to another. Without traceability the samples will not be tested.

1.13.6 Handling Samples

A significant number of packages containing samples are damaged before they are received by SMB. This damage may separate the sample from the documentation or obscure the sample identification if it is not marked properly. To ensure proper identification of samples the following requirements must be met:

- Packaging - Wire tie or strap together, box or bag, shrink wrapped or taped.
- Proper & secure identification - TL-101 should be with sample. Painted on identification or wired on tags. Clear taped over printed labels.
- Sample information must have protection from weather - Identification labels and TL-101's must be protected from moisture and damage.
- Coating protection - Coated samples should be encased in some protecting medium. Foam pipe insulation for epoxy coated rebar is good example.
- Timely shipping or delivery is essential - Don't hold the samples for a group shipment. Ensure that samples are shipped within a few days.

1.13.7 Testing

The Structural Materials Testing Section performs Quality Assurance testing of the many products used in constructing the state's bridges and highways. Upon receipt of test samples the following items are implemented to assure full compliance:

- Log in samples into a networked computer data base;
- Check what tests need to be done;
- Prepare samples or cut test coupons from submitted materials;
- Make physical measurements on the sample and record;
- Perform applicable tests and record results;
- Send prepared sample to others for specialized tests;
- Review all results and compare to specifications;
- Generate a test report stating the sample meets or does not meet requirements;
- Fax/e-mail results to inspection branch, structures representative, and/or SMR;
- Keep test report files.
- The Structural Materials Testing Section follows Caltrans Specifications (Standard and Project Special Provisions) strictly as written. From these specifications we use

the California Test Methods, ASTM specifications or AASHTO specifications or test methods. Test results precision is governed by the test procedure used, the test machine, and by requirements given by the specification.

- Credibility – All tests are based on known standards, follow published recognized procedures, performed on current technology test machines and are thoroughly documented on standardized forms.
- The test machines in the SM lab are calibrated by the machine manufacturer's representative. They provide National Institute of Standards and Technology (NIST) traceable standards for use during calibration and linearity verification
- Any transfer standards for calibration of small measurement devices (coating thickness measurement, load cells, pressure cells, etc.) are NIST traceable and records are maintained on site.
- All test reports and supporting work sheets and calibration reports are kept on file for 5 years.

1.13.8 Reporting Results

Test reports are developed for all samples sent for testing at the SM Lab. A tracking number is assigned and a receiving date is recorded when the sample arrives at the SM Lab. The format for the tracking number is SM 00-0XXX. This is broken down as Structural Materials, the last two digits of the year, and the number of the sample.

Testing results are E-mailed or faxed to the name listed on the TL-101 for the material, for example: the METS inspector through the inspection Branch Chief; the job representative (Resident Engineer or Structures Representative). For "stock" materials, the manufacturer's representative will be informed. The SMR will be cc'd on critical items on the jobs for which they are responsible. The results will be sent to a specific person if it is requested on the sample TL-101 form.

When inquiring about results, be prepared to provide sample type, the name of inspector who sampled it, the sample lot number, job information, & the TL-101 number.

<u>The following gives instructions on how to access the SMB testing database:</u>

1. You must have a copy of Filemaker Pro (version 4.1 or 5) on either the IBM or Mac platform and network access.

2. On the IBM Windows operating system, start the Filemaker software, go to File; open; then click on Host button (lower right).

Click on SMPS2000.FP3 and click OPEN button and it will ask you for a password.

You should get a HOSTS screen with SMT Desk as a heading. In the data base listings should be SMPLS2000.FP3. (Will be SMPLS2001.FP3 after July 1, 2001)

3. Click on OK. This allows you to view/search all records in the file. You can't change any entries without the password.

4. Click on Browse in the lower left corner. Then FIND.

5. Click on SM; then fill in the number or name in the entry fields to search for.

6. Click the FIND button in the left column. If more than one entry meets your search criteria, you can page through them by clicking on the page symbols in the upper left.

   - Backup test information is contained on test work sheets with pertinent physical measurements and the resulting remarks.

1.13.9 Problem Solving

The Structural Materials Testing Lab staff are available for consultation on sampling and testing problems or questions. We can meet with project engineers and contractor representatives to explain or discuss test results, evaluate field situations, investigate product problems, and explain testing procedures.

SM Lab staff will refer the Contractor or supplier contact to the SMR and the project engineer. Meeting with contractors and suppliers will always be at the request of the project engineer to the SMR. These discussions could cover items such as evaluating QC vs. QA testing procedures, comparison of testing with independent labs, or as simple as reviewing/recommending test equipment, fixtures, and operating procedures.

1.13.10 Test Reports

State test reports and written internal communications are for the use of the Inspector and the Resident Engineer. State test reports and internal documents will not be distributed outside the Department. Test results will be reported to interested parties verbally and may be discussed with reasonable discretion when necessary to establish complete comprehension of the meaning and effect of the test.

1.13.11 Qualified Products Lists (QPL)

The Structural Materials Branch maintains qualified products lists **(QPL)** for such materials as reinforcing bar couplers, zinc rich primers, expansion anchors, post-tensioning anchorages, anaerobic adhesives, etc. The materials on these lists are products that have passed specific qualification tests. Many of these tests are both expensive and time consuming and to perform routine qualification testing for all projects could result in long construction delays. Products on these lists may often be immediately used without further check testing. The QPL lists are made available to Contractors to facilitate the obtaining of approved products in an expeditious manner. The Department reserves the right to run additional qualification testing whenever it deems necessary. The most current QPL is located at the following internet site:

http://www.dot.ca.gov/hq/esc/approved_products_list/

1.13.12 Local Tests – Vendor and Private Laboratories

In order to expedite the release of materials, the Inspector may test or witness the testing of certain materials locally when so requested. Prior to witnessing testing, the Inspector should make sure it is allowed by checking with his/her Lead Inspector. This testing may be in done in the vendor's laboratory or private commercial laboratory at the vendor's expense. Test reports will be identified by the Inspector's Lot Number and contract number and must be signed by the Inspector, indicating that the test has been conducted properly, witnessed, and the test results conform to the contract requirements. When witnessing such tests, the Inspector shall attach copies of the test report with the Report of Inspection, when the material is released on the basis of the local test.

In some instances, as noted in various sections of the manual, a manufacturer's Certificate of Compliance, supplemented by a certified test report, identifiable to the material, may be used for acceptance in lieu of check sampling.

1.13.13 TL-101, Sample Identification Cards (SIC)

A "Sample Identification Card," Form TL-0101 (TL-0101 must accompany samples for QA testing, Identify the material on the form by its specification name rather than by its trade name. Include the required specification for the material if there is a question as to which specification might apply. Also provide the end use of the material and the contract item code. Inspectors must place their signature – not initials – as well as their assigned inspection lot number on the forms.

The forms must be filled in carefully and completely. If necessary, attach a note explaining anything unusual about the material. If the test samples are to be returned to the vendor (e.g. 5-gallon pails of paint or epoxy), include the vendor's address on the form.

Do not use TL-0101s when sampling cement or concrete: use Form MR-0518 for cement samples and Form TL-0502 for concrete samples
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1.14 AUDITS

1.14.1 Audits of Manufacturing Facilities

The SMR will review the Special Provisions (SP) to verify if any manufacturing and fabrication qualification audits (MFQA) are required. This requirement will typically be located in Section 8. These audits may include suppliers of structural steel, high strength fasteners, coatings, etc. The SMR should then perform the following steps in order:

1. Review the Contractor's self-audit for compliance.
2. Develop a schedule for performing the Caltrans audit with the Resident Engineer (RE) or Structure Representative.
3. Perform the audits and document any observations or findings in the audit checklist.
4. Generate a memo that summarizes the audit and distribute as applicable.

1.14.1.1 Procedures and Reporting

- All audits will be performed by experienced auditors. This will require all auditors to be accompanied by an experienced auditor who has previously performed this function when the auditor is performing an audit for the first time.
- Review the SP to determine which materials require the supplier to be audited.
- Review the SP to determine the timeframe for scheduling and performing the audits.
- Ensure the project files contain the DC-CEM-3101 for the manufacturing facility to be audited.
- The Contractor will submit to Caltrans the results of each self-audit for each facility using the audit forms in the SP. The SMR will review the self-audit in order to determine if the audit meets the minimum requirements of the contract, as required in the SP. If the self-audit is insufficient to perform an audit, the RE shall be notified with comments and recommendation for rejection.
- If the Contractor's self-audit is satisfactory, the SMR will relay this information to the RE, then assemble a qualified audit team, and coordinate a Caltrans audit of the facility within the timeframe required in the SP.
- A pre-audit meeting needs to be held at the facility to discuss the SP requirements. It is recommended to use the facility self-audit as the guide for discussion. The SMR should present a review of the self-audit and ask questions for clarification. During this discussion, areas of concern may be discovered that will require a more in depth review during the audit.
- Upon completion of the pre-audit meeting, conduct the Caltrans audit documenting and when appropriate, photograph material, events, or areas of concern as deemed necessary as evidence of both noncompliances and compliances.
- Upon completion of the audit, generate a completed audit checklist with METS comments from the audit. Attach photos from the audit to the completed MFQA

checklist and prepare a summary memo of the audit, identifying deficiencies and areas of concern. Distribute the audit report to the RE, and the office Chief.

- If the audit reveals discrepancies which would require re-audit, schedule and perform the re-audit (as described above), reviewing only the non-compliant or deficient areas, after the facility has corrected the deficiencies and requested a re-audit.
- The Contractor will typically have three opportunities to pass the Caltrans audit. Should the facility not pass the Caltrans audit on the 3rd attempt, the Contractor has the choice of using another facility, or accepting a deduction in payments for the products produced at the failing facility. After successful conclusion of the Caltrans audit and approval of the QCP, the Contractor will be approved to commence with production of products for the project.
- The Contractor may submit a QCP prior to, or after the Caltrans audit. SMR will coordinate review of the QCP, which has to be approved prior to start of operations for the project. Approval of the self-audit, or Caltrans audit, does not constitute approval of the QCP.

1.14.2 Audits of Precast Concrete Facilities

The SMR will know the procedures and reporting requirements for precast plant audits that are included in Section 8.2, titled "Precast Concrete Quality Control", of the designated Project Special Provisions. The intent of the audit is to ensure that the fabricator being audited complies with the requirements set out in the Caltrans standard specifications, special provisions and the project plans. Generally speaking, the audit process checks that the fabricator has the processes and the resources to fabricate the precast concrete products to the quality intended in the contract documents. In order to facilitate the audit process, the audit checklist form is used by the Caltrans auditors. A copy of the audit checklist is located at the following website:

http://www.dot.ca.gov/hq/esc/Translab/smbpubs.htm

The desired outcome of the audit process is a fabrication facility that demonstrates adequate processes and resources to produce quality precast concrete products. Although a passing audit is not necessarily a guarantee that a facility will produce products of the desired quality, it is an important first step in identifying and correcting obvious weaknesses related to processes and resources prior to actual production for the project.

The Structural Materials Branch should provide QA services for all precast plants producing structural elements commensurate with the magnitude of the project, and should consider amplifying its QA services for fabrication plants that are unable to pass the audits after repeated attempts.

1.14.2.1 Procedures and Reporting

The RE will notify the SMR of the precast fabricators by forwarding a copy of the Form CEM 3101 (formerly HC-30) supplied by the prime contractor. At this time, the SMR should coordinate (schedule and plan) all pre-precasting meetings requiring attendance by prime contractor and all subcontractors related to precast concrete work.

The agenda for the pre-precasting meeting should include, among other things, the requirements of precast concrete quality control special provisions. The intent of the pre-precasting meeting is for the entire construction team, including the contractor and Caltrans, to come to a common understanding of the quality requirements for the precast elements in the project. In addition, the agenda should also identify the roles and responsibilities of key personnel on the contractor's and owner's team. The SMR should provide adequate detail of the audit process and the associated timelines for the submission and review of the audits by Caltrans. A tentative schedule for the Contractor self audits may be agreed upon at the pre-precasting meeting.

Using Caltrans-supplied audit forms, the Contractor will submit results to Caltrans upon completion of its own self-audit. Caltrans has 15 days to review the self-audit. The SMR should review the self-audit in order to determine if the results of the self-audit pass minimum requirements of the contract, as spelled out in the Special Provisions. The Contractor may have to perform multiple self-audits in order to satisfy Caltrans' requirements for a successful audit. When the SMR is satisfied that the results of the contractor self audit are satisfactory, Caltrans will relay this information to the Contractor and the Contractor must request a Caltrans audit in writing.
The SMR should coordinate the performance and reporting of the Caltrans audit, which is to be completed within 50 working days of receipt of the written request for the audit. The Contractor's Quality Control Manager (QCM) and the plant's quality control personnel are required to be present during the Caltrans audit. Should the precast plant fail the audit, the Contractor can request up to two additional audits to attempt to pass.

If the precast plant does not pass on the third Caltrans audit, the Contractor has the choice of using another precast facility or accepting a deduction in payments for the precast products produced at the failing facility.

The Contractor must submit a Precast Concrete Quality Control Plan (PCQCP) for each precast plant being used. The SMR will coordinate a review of the PCQCP. Caltrans has 20 working days to review the PCQCP after the complete PCQCP is received. Refer to the Precast Concrete Quality Control Special Provisions for the minimum requirements for a PCQCP.

If the Contractor submits changes or amendments to the PCQCP, the SMR have the changes reviewed within 15 working days of receipt of the submittal from the Contractor. After the completion of the audit process and approval of the PCQCP, the Contractor will be allowed to start production of precast products for the project.

1.14.3 Manufacturing and Fabrication Qualification Audit (MFQA) form

The MFQA form is required per section 8-1.03 of some contract Special Provisions. The Contractor is required to submit the "Manufacturing and Fabrication Qualification Audit" (MFQA) self-evaluation checklist to the Engineer as part of the formal request for a facility audit. A copy of the MFQA is located at the following website:

http://www.dot.ca.gov/hq/esc/Translab/smbpubs.htm

Steel Manufacturers and Fabricators are only required to answer Sections A through L. Fastener Manufacturers and Fabricators are only required to answer Sections M through S. A detailed explanation shall accompany every answer. The detailed information provided should either explain how the facility is currently meeting the requirements (if answered "Yes"), explain how the facility intends on meeting the requirements (if answered "No"), or how this particular question is not applicable for this facility (if answered "N/A").

During the audit the same questions in the MFQA will be asked. Each Manufacturer and Fabricator will be evaluated per the requirements of Section 8-1.03 of the contract Special Provisions, then OSM will issue a report showing the answers of these items, as were discussed during the audit. In addition, photographs are used to document the audit.

It is the responsibility of the SMR to make sure that the audit forms are completed and transmitted to the Structural Representative in a timely manner. Samples of audit forms are included in Appendix F for illustration.

1.15 PROJECT PLANS AND SPECIFICATION REVIEW

1.15.1 General

For projects involving structural steel, precast concrete, and fabricated seismic components the Office of Structural Materials (OSM) may receive a copy of the plans and specifications for the purpose of review for Quality Assurance inspection and testing. These documents may be 60%, 80%, or 100% complete submittals. The copy may be forwarded from either the originating design section for in-house design, or by an oversight engineer if a consulting firm has prepared the design plans. It is recognized that the Caltrans design section or oversight engineer has the primary responsibility to provide review; however, other units such as OSM may be called upon to review specific aspects of the PS&E. The SMR is responsible for ensuring the PS&E review is completed and forwarding the resultant information to the appropriate parties. The following general items will be utilized as a checklist by OSM when reviewing the draft PS&E package.

For projects with precast concrete elements, OSM may be requested to review the plans and specifications for precast quality control and quality assurance requirements. OSM is also responsible for inspecting and releasing materials such as epoxy coated reinforcing bars, couplers and curing compounds.

The goal of OSM's review of the specifications and plans is to ensure that the Department's source inspection criteria and standards are met. Generally, most projects have generic and well-established source inspection criteria, however, some projects may have special source inspection criteria or standards that are not applicable to smaller projects. The review should focus on those parts of the plans and specifications that impact OSM's responsibilities for the project. The aim of the review includes removing errors and ambiguities related to inspection criteria and standards, verification of sampling and testing requirements, as well as requirements for releasing materials (if different from standard procedures established by OSM).

1.15.2 Plans

The plan review shall include the following items:

1. General Notes for:

    a. Labeling of steel types and grade
    b. References to other codes
    c. Bolt descriptions type and grade
    d. Description of FCM (Fracture Critical Members)
    e. Detail describing tension or compression members (for NDT and acceptance criteria)
    f. If the member or weld joint types are not described in the general notes, determine where this is documented within the plans, specifications or special provisions.

Welding and Steel Component Fabrication

- Cross reference all notes and schedules match specifications
- Review the general notes for labeling of steel material and grades, references to other codes, bolt descriptions and grades; and if shown, description of FCM (Fracture Critical Members), and detail describing tension or compression members (for NDT and acceptance criteria). If the member or weld joint types are not described in the general notes, determine where this is documented within the plans or specifications.
- Examine the various weld details, and comment on code compliance and/or construct ability. Note any prohibited welds, i.e. partial joint penetration welds detailed in a tension zone (see Section 9.8 of AWS D1.5). Discourage the use of all around symbols for anything other than circular shapes. Recommend symbols for complete or partial penetration welds be in generic terms, such as CJP or PJP, rather than detailing a specific weld joint.
- Ensure all corner and "tee" weld joints are reinforced with fillet welds.
- Comment on any details that may cause substantial fabrication difficulties or may result in poor quality due to access or construct ability issues.
- Comment on, if necessary, fit up of components (including such items as mill to bear or tight fit).
- Comment on any stiffener or attachment details (including shear studs) that may be difficult or impractical to fabricate or install.
- Comment on fracture critical members with issues.

Fasteners, Rods, Cable Restrainers and Stressed Anchors

- Look for clearances for access, hole spacing, intermediate and edge clearance of holes.
- Look for lengths of rods and specifications. Actual lengths may not allow certain coating processes. Pickling of rods may increase possibility of hydrogen enbrittlement.

Structural Precast Concrete

- Use form TL-6040 for documenting all drawing reviews or spreadsheet provided by others.
- Check for precast elements or structures. Check that concrete strength requirements are clear and release strengths are noted on the drawings.
- Cross-reference that all schedules and notes on sheets match specifications.
- In general, standardized precast for pile or girders will not require much detail on the plans.
- Verify clearances and allowable spacing of mild steel, tendons, and PT ducts. Include any penetrations for restraining cables and erection connections.
- Check bearing plate details and verify with abutments, pier tables or pier caps.
- Special attention is required where specialized precast components are used. Architectural reveals and designs require complete dimensions and elevations.
- Specialized precast components using concealed or adjustable fastening systems require special attention. Check for any obstructions with erection connections, and that a secure initial connection can be made quickly and efficiently, and that adjustment can be made afterward.
- Composite designs again require special attention. Look for constructability in field after Precast is set. Check locations of hoops or threaded rod insets for shear connection to

slabs, vertical and horizontal diaphragms. Initial design of precast needs to be made to correct final composite load and section design.

- Read concrete notes to see if special requirements for curing, especially steam curing are included. Make note of any special requirements that are not standard requirements.

1.15.3 Specifications

<u>*Welding and Steel Component Fabrication*</u>

- Review for any required audits as applicable.
- Review the portion pertaining to "STEEL STRUCTURES" in relationship to the details shown in the structure plans.
- Comment on appropriateness of specifications in general and in particular for: Fabricator(s) facility requirements (i.e. AISC Category "CBR"); material specifications and check testing; welding; QC; NDT; bolting; and coating.
- Comment on weldability and responsibility of costs.
- Review Section 4.8 and comment as needed.

<u>*Structural Precast Concrete*</u>

- Review Section 8-2 (Concrete) and comment on the section on precast concrete quality control, if applicable.
- If post-tensioning is to be performed at the precast yard, or anywhere other than the job site, review provisions in Section 10-1.26 Prestressing Concrete.
- Review Section 10-1.37 (Reinforcement for inspection, sampling and testing of epoxy coated reinforcement and ultimate butt splices).
- Document results of specification reviews in a memo.
- Check on any special aggregate or concrete testing requirements.
- Verify QA/QC requirements. If no QC requirements are listed, recommend that it be amended to include.
- Review any corrosion requirements in the way of surface coatings, mix requirements, or coated rebar or precast tendons.
- Look for special curing or casting requirements. Do these make sense?
- Are dimensional tolerances specified for finished pre-installed components?
- Check for surface finish, crack, or patching requirements. Are these clear or ambiguous? What type of sacking is allowed and what is not. Is there any visual or color requirements?
- Are there special fabricated or welded inserts, connections, or fasteners used; and if so, are the testing and fabrication requirements clearly specified?

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1.16 OSM UNIFORM FILING SYSTEM

1.16.1 General

Lead Inspectors and Administrative staff are responsible for ensuring that the OSM Uniform Filing System is properly used and maintained. This system enables easy access to information essential for proper management of a Quality Assurance and Source Inspection program as outlined in the Division Source Inspection Manual.

The OSM Uniform Filing System (as outlined below) is a user-friendly system designed to facilitate not only easy access to the project documents, but also provide easy retrieval and traceabilty of all the documents as needed by the Engineer. The system is easily scalable depending on project size. As the need arises, file categories are added into the main file body. It is not intended that all state contracts utilize this system as it was originally conceived for use only on major toll and new bridge projects or other contracts with extremely large volumes of paperwork.

1.16.2 Documents

As a minimum the SMR shall assure that the following documents are maintained in the filing system:

- All reports discussed above
- Other Correspondence
- Mill Orders
- Mill Test Reports
- Weld Procedures
- Q.C. Submittals
- NDT Reports
- Design drawings
- Shop drawings
- Special Provisions
- Contract Change orders
- RFI
- CEM-3101

1.16.3 System

The basic format of the filing system is such that the contract file is divided into groups that represent the prime contractor, field sub-contractors, and fabricators in that order. Within each of these groups, the file is divided into categories and sub-categories.

Every document is identified with a filing code number that will enable easy filing and quick access to documents when necessary. It is understood that not all contracts will need to incorporate all the categories listed in this chapter. As the contract file expands, as a result of the various documents such as (correspondence, forms, daily diaries, etc.), the file will add the appropriate categories as listed in the General Files Section of this chapter. However, there are certain categories that usually will be required for all contract files. These categories are listed as follows:

- Project Contract Information
- Correspondence
- Notice of Material to be Used (CME-3101)
- Notice of Materials to be Furnished (TL-0608)
- Report of Inspection of Material (TL-0029)

At the start of a project, every contract file should be set up incorporating these categories as a minimum. The file will utilize sub dividers with tabs for easy identification and retrieval.
The code number for all files big and small will be similar to the format listed below:

Contract # XX-XXXXXX
PP. CC. SS

5.5.1 (PP) Prefix**:**
The prefix will always be a one-or-two digit number that identifies who is performing and the location of the work being performed. Each inspector will be responsible for assigning the prefix to each document he/she generates. Explanation of the possible prefixes encountered follows:

1: Always identifies the work of the prime contractor and the majority of the general contract documents. Those general contract documents that are kept in the number 1 include: Project Contact Information, Special Provisions/Addenda, Requests for Information, Contract Change Orders etceteras. Other general files will also be found and kept in the sub-contractors and fabricator's files, but these are for information specific to those files.

2-9: Identifies documents associated with field sub-contractors other than the prime contractor.

10-99: Identifies documents associated with specific welding and steel fabrication shops, concrete pre-castors, or other specialized suppliers. These numbers are permanently assigned to fabricators.

The full listing of sub-contractor prefix and permanently assigned fabricator numbers is currently located in the SM folder on the T65emery server.
(CC) Category:
The category will always be a one or two digit number that identifies the type of document. This number will be a permanent part of all standard computer generated reports. Therefore, the inspector will not typically have to assign the category; however, documents received by the office must have the prefix and category numbers assigned before they can be filed. The full listing of categories is currently located in the SM folder on the T65emery server. The possible category codes are shown on the following page:

General Files	Category
Project Contact Information	.1
Special Provisions/Addenda	.2
Requests for Information	.3
Contract Change Orders	.4
Correspondence	.5
Shop Plan Review Transmittals	.6
Notice of Mat'l to be Furnished	.608
Report of Shipment of Mat'l	.6011
Report of Inspection of Mat'l	.29
Weekly Progress Reports	.6037
Material On Hand	.11
Daily Diaries	.12
*Continues…**	.13-.19

Welding Files	Category
Quality Control Plans	.20
Witness Reports	.21
Welding Procedures	.22
Welders and Operators	.23
Nondestructive Test Reports	.24
Nonconformance Reports	.25
NCR Resolution	.26
Shipping Records	.27
Continues…	.28-.39
Concrete Files	Category
File Subjects to be Identified	.40
	.41
*Continues…**	.42-.59

*Please note that the examples shown above are not complete.

(SS) Subcategory:
The subcategory differentiates between approved or rejected documents, resolved or unresolved, etc. The possible subcategories are listed below:

.A Approved or resolved documents
.B Rejected or unresolved documents
.FCP Distinction between the QCP and FCP documents
.UT Ultrasonic test reports
.MT Magnetic Particle test reports
.RT Radiographic test reports
.XX As required

To help understand the implementation and use of this filing system additional explanation is provided below.

1.16.4 General files

(X.1) Project Contact Information:
Upon creation of a new project file, the project contract information card must be completed. At a minimum this information will contain the name, address, phone number, and fax number of the Resident Engineer and the Structure Representative.

*(X.2) Special Provisions & Addenda**:***

This folder will contain only two copies of the special provisions and all addenda for the project. No other documents shall be stored in this folder.

(X.3) Requests for Information (RFIs**):**

Any RFI received from the Engineer or contractor, including responses shall be stored in this folder. This file may also exist in specific sub-contractor or fabricator files.

(X.4) Contract Change Orders (CCOs):

Any CCO received from the Engineer shall be stored in this folder. This file may also exist in specific sub-contractor or fabricator files.

(X.5) Correspondence:

All correspondence received or generated that does not fit into any other defined category (i.e. meeting minutes, letters issued by the Engineer) shall be stored in this folder. This folder will act as a “catch-all” for miscellaneous documents. This file may also exist in specific sub-contractor or fabricator files.

(X.6) Shop Drawing Review Record (TL-6040):

Copies of all transmittal sheets generated for shop drawing reviews shall be maintained in this folder.

(X.7) Notice of Material to be Furnished (TL-0608)**:**

Every TL-0608 generated shall be kept in this folder.

(X.8) Notice of Shipment of Material (TL-6011):
Every TL-6011 generated shall be kept in this folder.

(X.9) Notice of Release of Material (TL-0029):
Every TL-0029 generated shall be kept in this folder. This file may also exist in specific fabricator files.

(X.10) Weekly Progress Report (TL-6037)
Every TL-6037 generated shall be kept in this folder. This file may also exist in specific sub-contractor or fabricator files.

(X.11) Report of Material on Hand (TL-0649):
Every TL-0649 generated shall be kept in this folder. This file may also exist in specific sub-contractor or fabricator files.

(X.12) Inspection Reports (TL603x):

Every inspection report generated shall be kept in this folder. However, separate inspection report folders will be created and maintained for every welding location and/or welding sub-contractor. If welding is being performed in two different shops plus field welding, three different inspection report folders will be created and maintained; each within their prospective group.

(X.20) Quality Control Plans (QCP*):*

The QCP shall be stored in this file. Separate folders will be generated and maintained in order to separate acceptable and rejectable QCPs.

(X.20.FCP) Fracture Control Plans (FCP):

The FCP shall be stored in this file. This folder will also be separated between acceptable and rejectable FCPs or components.

(X.24) Nondestructive Testing (NDT) Reports:

All NDT reports generated during QA and QC inspections shall be stored in this folder. Because QA reports will be separated from the daily with which they were generated, the daily must reference the NDT report by date and contract number and <u>not</u> by stating "see attached NDT report". NDT reports are broken into sub-categories by discipline.

(X.25) Nonconformance Reports (NCR), TL-15:
All NCRs shall be stored in this folder, but separated on the basis of whether they are open or have been resolved. If they have been resolved, the resolution shall be stapled to the front of the NCR and both placed in the "resolved" folder.

(X.27) Shipping Documents:
All shipping records obtained from the fabricator during the course of the project shall be maintained in this folder and audited for completeness at completion of the project. A running log of materials shipped is maintained in this file at fabrication shops.
Typical Folder Tab Format:

General Files:

04-0440U4	**1.**	**9**
Report of Inspection of Mat'l		

Welding Files:

04-0440U4	**XKT**	**16.**	**22.A**
WPSs (approved)			

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1.17 JOB CLOSEOUT

1.17.1 Introduction

This chapter provides OSM Staff guidelines to perform the task of a job closeout of an assigned project, upon completion of construction activities. The job closeout procedure includes compilation of all necessary documents and records pertaining to a completed project at one centralized location. The location shall be where the function of Quality Assurance and Source Inspections are performed, i.e. the Office of Structural Materials Branch where the project resides. The completed file is forwarded to the RE for creation of a Project History File and disposal of irrelevant and duplicate documents.

The SMR, assisted by administrative staff, shall be responsible for job closeout of all the projects assigned to them by the Structural Material Branch Chief.

1.17.2 Administrative Staff Procedures

Job close-out begins once the QASI branch Admin Staff receive the “Contract Acceptance Form”, DC-CEM-6301 signed by the RE. The first step is removal of the completed projects file from the active area, disposal of duplicate documents, plans and all but one set of special provisions. At this time, the admin staff will attach the “Project Closeout Checklist” (Appendix G-1) on the outside of the file folder. The files to be closed out are moved to a separate area in the branch’s filing room, and the other QASI branches are notified that the project is being closed out, and asked to send all OSM documents they have, and dispose of all drawings and specifications.

If a Branch receives “Contract Acceptance Forms” for jobs in districts that are not the responsibility of that branch, the Admin staff will immediately forward all relevant documents to the appropriate SMR at the responsible branch. The special provisions and drawings that the non-responsible branch has should be disposed of. This can be done without input from the SMR.

1.17.3 SMR File Audit

The next step is for the admin staff to review the file with the appropriate SMR. The SMR will check the file for outstanding NCR’s, verify the inspection of critical bid items, and ensure all of the required METS documents are in the file. If there are major claims or NCR’s outstanding, the SMR should contact the RE immediately. This process is documented on the “Project Closeout Checklist”.

In addition to NCRs, the SMR should become familiar with any disputed issues and/or Notices of Potential Claims. The SMR should assist with the resolution and documentation of such issues and/or Potential Claims as needed. Once, the required documentation and resolution of the various issues have been completed project closeout can proceed.

1.17.4 File Transmittal and Disposal

Upon receipt of all the documents and records from other Offices of Structural Material Branches, the SMR shall review all the documents and ensure that all NCR's are resolved and there are no outstanding claims. Depending on the status of these issues, and any solutions offered by the RE, the SMR will prepare one of the following three transmittal letters to send to the RE with all of the OSM documents:

- Letter A – Used when NCR's remain unresolved, and the RE doesn't feel special resolution is warranted (Appendix G-2).
- Letter B – Used when there are no NCR's outstanding, but critical bid items that would normally have had METS inspection and release were not verified (Appendix G-3).
- Letter C – Used when there are no outstanding issues with respect to the project – i.e. all NCR's are resolved and all items received QA verification (Appendix G-4).

For cases where there was no METS involvement required on a project, after confirming that no QA was done, the SMR simply directs the Admin staff to dispose of any documents that the branch may have.

Furthermore, any NDT data including UT reports and RT film needs to be audited and forwarded to the appropriate staff at the Division of Maintenance.

1.17.5 Final Transmittal and Disposal of Project Documents

After the SMR and the Admin Staff collate all OSM documents for the project, and determine the final resolution of all outstanding issues, the file with the appropriate transmittal letter will be forwarded to the project RE. The RE is responsible for creation of a project history file, and any required archiving of documents related to the project (Construction Manual, Chapter 5 and Project Development Procedures Manual, Chapter 7). As such, METS has no responsibility to maintain archived records. Once all OSM documents are sent to the RE, any remaining specifications and drawings should be discarded. A copy of the transmittal letter and contract acceptance form are the only records that need to be kept in the OSM branch, and all such documents should be kept in a centralized location (filing cabinet or binder).

On projects where this close-out procedure was not followed, disposal of the files can be done with no notification to the RE under the following conditions (from the Construction Manual, Chapter 5, § 5-104C):

- For projects that involve federal participation, records can be disposed of three years after submission of the final voucher.
- For projects that do not involve federal participation, records can be disposed of three years after the date on which the final estimate is scheduled for payment.
- For projects on which some legal question exists, such as a pending claim, a labor compliance case, or litigation, records can be disposed of three years after settlement. The

district construction office must send a memorandum to the district records officer to hold these records until further notice.

Notification of the RE for projects finished over two years ago is extremely difficult given the constant movement of personnel within CalTrans. Furthermore, as METS has no responsibility to maintain archives, and the project history file was completed by the RE within 30 days of project closeout, there is little value to be gained compared to the amount of work that would be involved in tracking down the RE. Thus, discarding of old project files can be done with the Branch's discretion.

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Section 2. Miscellaneous Manufactured Materials

2.1 GENERAL INFORMATION

2.1.1 Scope and Organization of Part 2

2.1.1.1 Scope

This part of the manual describes source inspection information for those materials which fall into the category of miscellaneous manufactured materials. The Inspector must use the same diligence and care when inspecting these materials as with more critical bridge materials. However, the lower criticalities of some miscellaneous materials are such that extensive inspections and check testing may not always be warranted. In lieu of performing source inspections, some of these materials, particularly those from established manufacturers, may be job-site-inspected by the Resident Engineer and accepted on the basis of visual inspection and certificates of compliance. The inspection guidelines provided in this manual for miscellaneous materials are based on current specifications and past successful inspection practices. These guidelines are not intended to supersede the requirements of the contract plans and specifications, which will always take priority, but rather to provide general directions when assigned to perform source inspections on miscellaneous structural materials. The contract requirements for most miscellaneous materials will generally remain the same; however, the Inspector is reminded that exceptions can occur and the specific contract requirements must be researched before each inspection assignment. (See policy on Releasures and Job Specifications.)

It should be noted, however, that the information provided in relation to the various miscellaneous manufactured materials is intended to be a guide for the Inspector. In some cases there may be more information listed than is required by the contract specifications. The intent is not to imply that the Inspector is required to do everything that is listed in this inspection manual in relation to the inspection of a particular material.

2.1.1.2 Organization of Part 2

Items having similar properties and inspection requirements have been grouped together under a general heading whenever possible. In other instances associated miscellaneous materials have been grouped for descriptive convenience. Cross referencing has been used when appropriate. Basic steps of inspection for sampling, testing, dimensional checking and visual inspection have been detailed herein to supplement the plans and specifications. For the listed miscellaneous materials in this section the Standard Specification reference and commonly referred to ASTM and AASHTO specifications are provided to facilitate the Inspector's job of researching the material requirements

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2.2 CONCRETE REINFORCEMENT AND ACCESSORIES – MOVED TO SECTION 3

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2.3 METAL CASTINGS AND FORGINGS

2.3.1 Steel Castings

2.3.1.1 General

Steel castings may be used for important bridge components or minor items of lesser structural importance. The requirements for most metal castings will generally be listed in Section 55-2.01, 2.03 and Section 75-1.02 of the Standard Specifications and casting details in the Standard Plans. The most commonly referenced specification for mechanical and chemical properties is ASTM A 27/A 27M. Most commonly specified is Grade 65-35, which requires a minimum tensile strength of 65 ksi and minimum yield strength of 35 ksi. ASTM A 27 includes a number of supplementary requirements. Some proprietary items may also be made from steel castings in which case they must conform to the manufacturer's specification only.

2.3.1.2 Inspection

Refer to the contract special provisions and plans for the end use and specification for the steel castings to be inspected. Castings shall conform to the specified dimensions and weight requirements within the allowable tolerances. Continuous fillets must be cast in all re-entrant angles as required by the specifications. Surfaces must be inspected for casting defects. Minor defects may be repaired by welding or grinding. Major casting defects may be cause for rejection. Weld repairs, as allowed by the specifications, may be performed. Cast surfaces shall be thoroughly cleaned and machined surfaces shall be properly protected from rusting.

2.3.1.3 Sampling and Testing

Test coupons may be cast separately as test coupons with the pour, cast integrally with the casting, or cut from the casting. Test coupons are to be identified by heat and treating charge number. One tension sample is normally required per heat.

Chemical analysis and physical testing will preferably be performed by the foundry or a competent independent testing laboratory. The Inspector may accept certified test reports and a copy of the heat treating record which he/she feels confidently are representative of the heat. Otherwise the test coupons are to be forwarded to the Office of Structural Materials for testing. Such samples should be accompanied by all furnished test data and heat treating records. Radiographic Testing (RT) shall be performed when specified. Results of tests must meet specification requirements. Review of RT NDT reports shall be reviewed by inspectors who are certified and qualified as a level II to the Office of Structural Materials' Written Practice for RT.

2.3.1.4 Heat Treating

Heat treatment must be performed in accordance with specification requirements. A copy of all heat treating records will be required prior to acceptance. Castings that fail to meet the physical test requirements may be subjected to additional heat treating at the option of the manufacturer.

2.3.1.5 Reporting

Tag and release acceptable materials. Report the number and description (refer to Standard Plan or contract plan sheet) of the castings, specification and grade, and the actual scale weight of the shipment, when the item is paid on actual scale weight, on the Report of Inspection TL-0029. Castings must be produced domestically when so required.

2.3.2 Iron Castings

2.3.2.1 General

General requirements for gray iron castings are listed in Section 55 and Section 75 of the Standard Specifications. The commonly used reference specification is ASTM A 48. Class 30B, which requires a minimum tensile strength of 30 ksi (207 Mpa).

Refer to the contract special provisions and plans for specific requirements and casting details. Commonly used iron castings will be detailed in the Standard Plans. Although iron castings are not normally used in critical applications, sampling and testing may be required to verify specification conformance.

2.3.2.2 Sampling and Testing

Test bars are separate castings poured with the same iron as the castings as prescribed in ASTM A 48. ASTM provides for tensile testing and flexure testing of prescribed test bars. The foundry is required to conduct the required tests or have tests conducted by a competent private testing laboratory. The Inspector may accept these test results if he/she confidently feels that they represent the castings furnished. A Certificate of Compliance with certified test reports may be accepted in lieu of check sample testing by the Office of Structural Materials.

Many iron castings are being produced by foreign foundries. Many of the standard types for city and county agencies are of foreign origin in which case the country of origin will be cast in the part. Domestic certification must be provided when so required.

2.3.2.3 Inspection

Inspect castings for weight, dimensions, and surface defects. Castings containing spongy metal, blow holes, cracks or other defects that will seriously impair their strength or usefulness shall be rejected. Repairs may be made by welding with welding electrodes intended for welding cast iron. Cast-in lettering or markings, such as required on manhole lids, shall be clearly legible and shall conform to the project specification requirements. Cast iron manhole rings and covers or any other matching units must fit together without rocking. Contact surfaces are usually machined. Castings will generally be painted with black asphaltum paint to protect them from corrosion.

2.3.2.4 Reporting

Castings that pass visual inspection and required tests may be tagged and released. Report the number and type of castings (refer to Standard Plans) along with the actual scale weight of the shipment, when the item is paid on actual scale weight. Domestic certification must be provided when required.

2.3.3 Forgings

2.3.3.1 General

Unusual shaped steel parts are often more economically manufactured by the reshaping of other standard steel sections rather built up by welding or extensive machining. Forging also preserves and enhances the structural properties of the steel. Typically, many of the eyebar and ringed connections used in cable and pinned connections are forged. The single and double cable end anchor bars for guard railing may be forged as an option. Larger round pins and rollers used for structural steel bridge connections and bearings are more economically produced by the forging process. Section 55-3.15 specifies the requirements for forged and heat treated pins and rollers for bridge application. ASTM Specification A 668 is the reference specification used for carbon steel and alloy steel forgings, Class D and G, respectively.

2.3.3.2 Inspection, Sampling, and Testing

Review the contract special provisions and plans for the specification requirements. Forging is a highly specialized process and large forgings are generally supplied from out-of-state locations. Forgings are not commonly inspected materials, as their use is quite specialized.

Small proprietary parts such as cable clips and small eyebars may be accepted on the manufacturer's catalog values and certifications. Larger forgings used for critical bridge applications will generally be custom forged. The required sampling and testing requirements for which the manufacturer is responsible will be listed in ASTM A 668. The Inspector will perform visual inspections of the forgings for general workmanship, dimensions, galvanize coatings (when required), and any required manufacturer's markings. Refer to special requirements for 9-inch-diameter and larger forged pins in Section 55-3.15. Obtain the manufacturer's certified chemical and physical test reports and heat treatment reports (when required) and review for specification conformance.

2.3.3.3 Reporting

Tag and release acceptable material. Report the quantity, description of part, any surface finish, and the specification and grade on the Report of Inspection TL-0029.

2.4 MISCELLANEOUS IRON AND STEEL AND BRIDGE METAL

2.4.1 General

Materials inspected under this category will generally be those of a lower structural importance than load carrying structural steel bridge members. The materials and workmanship requirements for these materials will be commonly specified under Section 75 - Miscellaneous Metal of the Standard Specifications or included in other sections. The Inspector is cautioned to review the special provisions for special requirements for fabrication and welding of bridge strengthening members used in seismic retrofit projects. Although these members may be listed as miscellaneous bridge metal, welded fabrication may be governed by the more stringent requirements for weld quality control and AWS D1.5 Bridge Welding Code or the Standard Specifications or Special Provisions.

For descriptive purposes this section will include not only items normally classified as "Miscellaneous Iron and Steel and Bridge Metal" in the Engineer's Estimate, but also various other related items that often appear in other bid items. These instructions cover the general inspection requirements for metal parts of manholes, drainage structures, bearing assemblies, bridge decks, ladders, cattle guards, trash racks, railroad rail, pump houses, sheet metal, small buildings, and other similar items of less critical structural importance. Steel bars, plates, shapes, and other steel components may be commercial quality weldable grades with only chemical composition requirements. Welding will generally be governed by the AWS D1.1 Structural Welding Code, rather than AWS D1.5 Bridge Welding Code.

2.4.1.1 Inspection

Specifications require that fabrication shall be performed in a workmanlike manner in conformance with the practice of industry standards of commercial steel fabrication shops. Dimensions of fabricated members shall conform to those shown in the Standard Plans or as otherwise shown on the contract plans.

Welding shall conform to the requirements of AWS D1.1 Structural Welding Code, except as superseded by the contract special provisions and plans. This requires the submittal of welding procedure specifications and welder and welding operator qualification records. All welding related documents shall be reviewed by the Inspector prior to any welding operations and recommendations for acceptance or rejection given to the Resident Engineer. Because much of the miscellaneous metal fabrication is repetitive, established miscellaneous metal fabricators will submit welding procedure specifications and welders' certifications periodically, upgrading these whenever there are changes in the welding procedures and welding personnel. Nondestructive testing of welding is normally not specified for these materials. Nonetheless, the Inspector must be on the alert for bridge strengthening components which may require nondestructive tests. The supervisor of each Quality Assurance and Source Inspection Branch must verify if an American Welding Society Certified Welding Inspector (CWI) is required to perform the inspection. For example, if the contract documents require that the contractor's Quality Control inspector be a CWI, the Quality Assurance inspector should also be a CWI.

The Inspector shall perform visual inspections of the work in progress and the completed work to verify substantial conformance to the specification requirements. Quality control is the Fabricator's responsibility. The Inspector shall be satisfied that the Fabricator is competently performing the quality control required to provide acceptable workmanship. The Inspector shall be careful not to assume the Fabricator's quality control responsibility.

Galvanized coatings, both hot-dip or mechanical, will generally be required on miscellaneous metal furnished. Roadway frames and gratings do not require galvanizing. It is important that all weld flux and splatter be removed from welds and adjacent areas, as these cannot be removed during the cleaning ("pickling") operation, resulting in poor or no galvanizing adherence. A magnetic thickness gage may be used to verify the required galvanized coating thickness. Distortion and warping commonly occurs to welded components when hot-dip galvanized. Warped components shall be straightened. Vent and bleed holes drilled in parts must be approved. Any tapped holes that have been galvanized must be "chased" to remove excessive zinc buildup in the threads so as to prevent seizing of bolts. It is customary to tap holes after galvanizing. (Re: Sec. 2.4.8 for Galvanizing Inspection Procedures)

2.4.1.2 Sampling and Testing

Unless otherwise specified in the contract documents, steel components will be released for fabrication on the basis of certified mill test reports identifiable to the steel being fabricated. Quality assurance check samples shall be taken at sufficient frequency to support any furnished test reports. Domestic certification must be furnished, when so required. Standard sampling procedures for steel, anchor bolts, and hs. fasteners shall be used for check sampling. The specification for check samples must be noted on the Sample Card TL-0101, as the steel used for miscellaneous metal may be commercial quality and chemical tests may only be required.

2.4.1.3 Reporting

As previously stated, this category covers several types of miscellaneous metals. Although the majority of these materials will be governed by Section 75 Miscellaneous Metals, the unit of measurement for payment may vary considerably. Contracts may require that these materials be paid for by the pound or unit. It is therefore essential that the materials released be identified by contract item and the quantities shipped be expressed in the units for the specific bid item.

The Inspector will be responsible for obtaining the correct weights of material when the unit of payment is in actual pounds. He may report his own witnessed weights or obtain certified scale weights from the vendor to cover each shipment. When certified scale weights are furnished, a copy of the weight ticket is to be attached to the Resident Engineer's copy of the Report of Inspection TL-0029. Otherwise, use estimated weights.

2.4.2 Bridge Bearings

2.4.2.1 General

Fully mechanical type (rockers, roller nests, etc.) steel bridge bearings, fabricated from built-up welded and cast steel components, are infrequently chosen by today's designers. To compensate for the everyday non-seismic movements and loads (expansion, contraction, and rotation) the modern bridge bearings now utilize elastomeric bearing pads in conjunction with PTFE slide and spherical bearings for most steel and concrete bridges of conventional design. Unusually long bridges of non-conventional design may utilize special combinations of all types of bearing devices including pinned and hinged steel components. As the bearing assemblies must support the bridge loads and accommodate many cyclic movements, they are critical to the bridge's function and longevity and therefore require a high level of source inspection and check testing of component materials. If NDT is required, the Inspector must be certified and qualified to the Office Written Practice for the NDT method specified.

Mechanical Type

These bearings are usually of welded steel fabrication. The designs provide for movement using pinned rockers and hinges, steel rollers, etc. Materials and fabrication are the same as for structural steel bridge members. Rocker bearings usually consist of pinned upper and lower steel segments usually joined by numerous complete penetration welds. Large pins are usually forged steel. Specifications generally require that they be stress relieved after machining. Welds must be examined carefully for cracks. Magnetic particle inspection (MT) may be specified for the welds. Because of the large complete penetration welds and specified thermal stress relieving distortion and warping often occurs. Close visual inspection of the welded built-up bearings must be made to verify straightness and flatness of the bearing surfaces.

Seismic Isolation and Energy Dissipation Devices

Because of the high seismic risk in California, many of the bridge bearing devices are designed to both support the bridge and act as seismic isolation and energy dissipation devices should an earthquake occur. These are complicated devices, and source inspection involves evaluating special materials and manufacturing processes, and witnessing prototype and proof tests performed by the manufacturer. Inspectors should have fundamental engineering knowledge of how these devices will react in a seismic event. Testing involves complicated testing and mathematical analysis of the test data. Inspection of these devices requires specialized knowledge, and the Source Inspector must be knowledgeable and properly trained. Because of the complexity of these devices and frequent change in technology, general inspection procedures will not be furnished in this manual. Inspection of seismic bearings must be conducted on a job-for-job basis. Inspectors must thoroughly review contract special provisions and plans when inspecting these devices and not hesitate to contact their Supervisor if they do not thoroughly understand the contract plan details and testing requirements.

Friction Type Bearings (PTFE and Spherical Bearings)

These bearings are designed to accommodate temperature movements and rotation due to angular movement of bridge girder members. Performance of these bearings is dependent on predictable frictional resistance of the moving components. The structural components of these bearings are welded steel plates, using elastomeric pads and slide components (polished stainless steel and PTFE mating surfaces) with designed frictional resistance. Friction testing and proof loading by the manufacturer are specified. Inspection, sampling, and testing will be governed by contract plans and special provisions. Testing parameters are listed in contract plan, based on design requirements. Inspectors must have the mathematical abilities to evaluate the test data obtained during both prototype and proof testing. The Branch Supervisor shall provide the training needed to perform these inspections.

2.4.2.2 Inspection, Sampling, and Testing

The following applies to all types of bridge bearings:

1. Thoroughly review the contract special provisions and plans and any required working drawings for the bearing details, material requirements, and testing procedures required to be performed by the manufacturer. Verify that stainless steel surfaces are polished to the specified finish and stainless steel electrodes are used when welding stainless steel.

2. Sample all component materials as required by the specifications for testing by the Office of Structural Materials. Obtain all required certificates of compliance and certified test reports for materials.

3. For welded components, obtain the WPS and welders' certifications as required by the governing AWS Code prior to fabrication. Be sure that welding of stainless steel components conform to the required welding procedures. D1.5-1.3.6 defines bearings as ancillary products. WPS's are prequalified, but D1.5 does not cover stainless steel.

4. Conduct inspections at a frequency during manufacture to ensure substantial conformance of the materials and workmanship to the specification requirement. Visually inspect completed units to ensure compliance with the required welding details, machined surface finish, match markings of components, and all bearing surfaces within the flatness tolerances. Detailed quality control inspection during production is the manufacturer's responsibility.

5. Witness all testing required to be performed by the manufacturer. Prototype testing of seismic isolation bearings and energy dissipation devices may be witnessed by the Division of Structure Design. In such instances, only the proof testing will be witnessed by the Office of Structural Materials Source Inspectors. Inspectors must verify that the friction tests, prototype and proof testing are conducted in accordance with the performance criteria listed in the contract plans. The specifications may require that each bearing be proof tested. Copies of all tests performed by the manufacturer must be

furnished and reviewed by the inspector for completeness and accuracy. Per the special provisions for the particular contract, working drawings or calculation sheets may be required to be signed by an engineer who is registered as a Civil Engineer in the state of California.

6. When paint or galvanize coatings are specified, ensure that specified paints are being used and properly applied. Inspect galvanizing in accordance with Sec. 2.4.8 of this manual.

7. Bearing assemblies consisting of several mating components are usually required to be match-marked with the components bolted together as a single complete bearing. Verify that each bearing assembly is properly packaged for shipment.

2.4.2.3 Reporting

Tag and release acceptable bearings. List the quantity and type (as shown on the contract plans) on the Report of Inspection. All corroborative materials and test reports must be placed in the local Quality Assurance and Source Inspection Branch and Office of Structural Materials files following the final inspection. The designer may also request that copies of all witnessed tests be forwarded for their review.

2.4.3 Drop Inlet Frames and Grates

Drop inlet grates and frames shall be those specified in the contract plans. General details for standard frames and grates will be found in the Standard Plans with materials and workmanship specified in Section 75 Miscellaneous Metal of the Standard Specifications. Except for those on bridge structures, grates and frames are not required to be galvanized. Welding is required to conform to AWS Welding Code D1.1 Structural Welding Code.

2.4.3.1 Sampling and Testing

Cast steel and iron parts shall be sampled and tested in accordance with the applicable instructions given in Section 2.3 of this manual. Structural steel shapes, plates, and bars may be accepted on the basis of certified mill test reports and the manufacturers Certificate of Compliance. Commercial quality steel with weldable chemistries, as listed in Section 75-1.02, are permitted to be used in fabricating frames and grates. Obtain random check samples of steel as directed by your supervisor.

2.4.3.2 Inspection

Frames and grates may be either of cast steel or fabricated from welded steel components. Welded frames and grates are usually fitted and welded in welding “jigs” which will usually provide consistent dimensions and help to control welding distortion. Welding must be performed in accordance with AWS D1.1. Obtain copies of current welders’ certification test records for placement in local Quality Assurance and Source Inspection Branch files.

Cast steel frames are usually cast in two or more sections and welded together in the final assembly. The welding procedure must produce complete penetration welds, and all weld reinforcement that would interfere with proper fit of the grates and frames must be removed by acceptable means such as grinding or chipping.

Grates and frames are required to be assembled in the shop and match marked for field assembly. The grates must fit in the frames without rocking. The manufacturer's standard frames and grates should be spot checked on a regular basis to ensure correct dimensions.

When galvanizing is required, inspect for surface quality and coating thickness with a magnetic thickness gage.

2.4.3.3 Reporting

Tag and release acceptable material. Report the quantity, type, galvanizing when required, and either the estimated or actual scale weight, as required, on TL-0029 Report of Inspection.

2.4.4 Cast Iron Manhole Rings and Covers

2.4.4.1 General

Standard dimensional details, materials, and workmanship are listed in the Standard Plans and Section 75 – Miscellaneous Metals of the Standard Specifications. On some occasions local city and county requirements will govern. Check the contract special provisions and plans. Requirements for cast iron are most frequently referred to ASTM A 48, Class 30B.

2.4.4.2 Sampling and Testing

Refer to Section 2.3.2 Iron Castings

2.4.4.3 Inspection

Castings are to be checked for weight, dimensions, surface defects and compliance with the project specifications. Cast-in lettering on the covers must comply with the project requirements. Rings and covers must be shop assembled and fit together without rocking and must be match marked in the shop for assembly on the job. The protective coating will be either a bituminous coating or hot-dip galvanizing as set forth in the project specifications.

2.4.4.4 Reporting

Tag and release acceptable materials. List the quantity, description, specification, and estimated or actual scale weight, as required, on the Report of Inspection TL-0029.

2.4.5 Miscellaneous Metal Parts and Assemblies

The basic inspection procedures will apply to all items composing this group which includes metal parts for drainage structures, steel manhole and ladder steps, curb armor, deck drains, expansion dams, pump house parts, light wells, cattle guards, trash racks, stair treads, hardware, and related relatively small steel assemblies. Most of these items are detailed in the Standard Plans or in the contract plans. Materials and workmanship will generally be referred to Section 75 - Miscellaneous Metal, Miscellaneous Bridge, and Bridge Joint Restrainers of the Standard Specifications. Materials specified under this section do not generally have the criticality of materials specified under Section 55 Steel Structures and are considered as ancillary or secondary members. However, many smaller and less critical miscellaneous metal components may be covered in other sections of the Standard Specifications. Proprietary or commercial quality products may also fall under the heading of miscellaneous metals. Any miscellaneous bridge metals whose principal function is for seismic strengthening should be considered with the same critical value of structural steel bridge members and the degree of inspection discussed with the supervisor.

2.4.5.1 Sampling and Testing

Certified mill test report may be accepted in lieu of sampling and testing at the option of the Branch Supervisor. Some steel materials specified under Section 75 need only meet chemical composition requirements. Mechanical properties are not specified. However, certified mill test reports will be required to verify chemical composition. A Certificate of Compliance from the supplier should also be obtained for the completed product. Where there is any doubt as to the quality of the material furnished, check samples must be taken for chemical analysis or mechanical properties tests. Periodic check samples should be taken to supplement mill test reports for standard stocked items, such as frames and grates, downdrain pipes, steel pull boxes, etc. If "commercial quality" or a proprietary product is specified, visual inspection is usually sufficient and tests will not be required. Domestic certification for small metal components listed on the Office of Structural Materials exception list may be waived subject to the supervisor’s discretion. Otherwise, domestic certification must be provided when required.

Galvanized coatings shall be inspected in accordance with the instructions in Section 2-308 Galvanizing of this manual. Normally, a magnetic thickness gage will be sufficient to evaluate coating weight. The Inspector should note random thickness measurements in the Inspector’s Shipping List. Galvanizing shall be evaluated for workmanship and adherence.

2.4.5.2 Special Instructions

A multitude of products of varying criticality fall under this category, some of which may be infrequently encountered. The Inspector must review the contract documents before performing inspections. Regardless of the quantity, the structural importance of the item should dictate the extent of inspection, check sampling, and testing performed. Discuss this with the supervisor of the local Quality Assurance and Source Inspection Branch.

Items that are used on bridge structures, such as fabricated steel expansion dams, seismic strengthening components, special restraint members, etc. have greater structural importance and must be more closely inspected. Occasionally, such materials may be improperly specified under the miscellaneous metal requirements. If the Inspector has any questions on the specifications, this should be brought to the supervisor's attention.

In addition to the standard procedures for dimensional and visual inspection, many of the items included in this category may require other special quality control on the part of the manufacturer. The Inspector should bring these to the manufacturer's attention and see that all requirements are fully understood. All fabrication processes should be monitored at the intervals necessary to satisfy substantial compliance with the materials and workmanship of the specifications. The Inspector must also be satisfied that the manufacturer is conducting the necessary level of quality control to ensure a consistent and quality product. If questions arise as to the adequacy of the quality control, the Inspector shall contact his supervisor. If needed, the supervisor will contact the Engineer to discuss the issue.

2.4.6 Open Steel Flooring and Gratings

Open steel flooring and grating shall conform to the project specifications. These are generally rectilinear designs of riveted and welded construction and may be a specific proprietary design such as "Irving Subway Grating". Requirements for open steel floorings and gratings and other special deck floors, such as checkered steel plate, will generally be specified in the contract special provisions and plans. Inspection will generally consist of visual inspection to ensure the grating conforms to the manufacturer's data sheet. Verify the products are domestic when so required.

2.4.6.1 Inspection

Check workmanship, dimensions, and gage. Galvanized flooring and grating should be checked for possible cracking developed during the galvanizing process at tight bends and at weld locations. Seal welding of the riveted faying surfaces will not normally be required. The specifications may specify the steel flooring to be a proprietary product of an established manufacturer and the material may or may not be specified by ASTM number. Mill tests reports for steel components should be obtained to verify if the manufacturer is providing the product described in their technical data sheet.

2.4.7 Guard Rail Cable Anchors and Seismic Restrainers

2.4.7.1 General

The standard cable anchor used for guard rail and as seismic restrainer cables are detailed in the Standard Plans. Materials and workmanship requirements are listed in Sections 75-1.035 and 83-1.02B. Restrainer cables consist of a 19-mm-diameter, 6 x 19 IRWC wire rope that is attached to a swaged steel fitting with threaded high-strength threaded stud (ASTM A 449) and nut. The wire rope length will vary, and where length adjustment is necessary, a specially designed pipe turnbuckle is specified. Turnbuckle details are shown in the plans and material requirements in Section 83-1.02B.

2.4.7.2 Inspection, Sampling, and Testing (as directed by applicable specifications)

One sample of cable properly fitted with swaged fitting and right-hand thread stud at both ends, one meter in total length, and one sample of turnbuckle, when required, fitted with a 200-mm stud at each end shall be sampled for each 200 cable assemblies or fraction thereof. Obtain certified mill test reports and heat treatment reports for component parts:

- Cable - Federal Spec. RR-W-410D
- Stud - ASTM A 449, Quenched & Tempered Steel (Verify with metallograhic test sample)
- Nuts - ASTM A 563, including Appendix X1, except lubrication is not required
- Swaged Fitting - AISI C 1035, annealed, suitable for swaging (Verify with mill test report)
- Pipe Turnbuckle - Commercial quality, no mill test report required

The manufacturer of the swaged fittings must stamp their identifying symbol on each swaged fitting. Internal threads of the swaged fitting and pipe turnbuckle and stud nuts shall be checked for overtapping. Overtap tolerances are listed in Section 75-1.05. Use “go/no-go” gages.

Damaged galvanizing and oil from the swaging operation must be cleaned and repaired with two coats of organic zinc primer. Verify that the retaining pin for the studs has been installed. The cable assemblies shall be shipped as a complete unit, including stud and nut and turnbuckle, when required. If the cable supplier is furnishing the neoprene or tension washers required for seismic restrainer cables, verify that these conform to the contract requirements.

2.4.7.3 Reporting

Tag and release cable assemblies which conform to all check testing requirement and pass visual inspection. Record the quantity of cable assemblies, type (guard rail or seismic restrainer), lengths, and any additional components such as turnbuckles, neoprene or tension washers on the Report of Inspection TL-0029.

2.4.8 Galvanizing

2.4.8.1 Inspection

In general, galvanizing of steel highway and bridge products is governed by Section 75-1.05 Galvanizing of the Standard Specifications, which in turn references ASTM A 123 and A 153 for hot-dip galvanized zinc coatings. Galvanized coatings (zinc) are applied to many steel products. These may include fabricated steel products, steel plate, sheet, and shapes, iron and steel castings, tubular sections, fasteners, etc. Galvanized coatings can be applied by either hot-dip galvanizing (HDG) or a mechanical coating process, governed by ASTM B 695. Mechanical galvanizing is limited to small parts, generally studs, bolts, nuts, and washers. Some high-strength fasteners and fastener components, such as TC bolts and DTIs, are required to be mechanically galvanized as this method provides a more uniform and consistent coating thickness on threaded parts which in turn provide a more uniform thread friction and less probability of thread seizures. Coating thicknesses required on highway and bridge materials may vary. Another method of applying zinc coatings is metallizing, in which molten zinc is sprayed directly on prepared steel surfaces. This may be permissible on some sign support structures. Thermal spraying of zinc is governed by AWS C2.18.

2.4.8.2 Coating Thickness

Specifications require a minimum zinc coverage. The required coverage is normally specified in ounces per square foot of zinc coverage. 1 oz. per square foot = 0.0017" (or 43.2 µm). Therefore, 2.0 oz. per square foot = 2 x 1.7 mils = 3.4 mils. A quantitative analysis of the zinc coating coverage can be performed in the Laboratory by weighing a representative test coupon and stripping the zinc to bare metal and calculating the weight of the deposited zinc per square foot of coverage. Note that the weight of coating for many sheet products is based on a total weight of zinc coverage, based on the total weight on both sides of the sheet (e.g. 2 oz. per sq. ft. = 1.7 oz. per sq. ft. on each side of the sheet). However, current source inspection practice is to take thickness measurements with a magnetic thickness gage to determine if there is sufficient zinc coverage. The thickness requirements vary with the type and thickness of materials. The Inspector must first determine what the applicable specification is before conducting thickness measurements. Guidelines for magnetic thickness measurements are in California Test Method 652. The following table of specification references in Table 2-X will assist the Inspector in determining the required zinc thickness.

2.4.8.3 Coating Adherence

In addition to the required zinc coverage, adherence of coating must be evaluated. Adherence is measured by the "stout knife" test. The point of a stout knife is used to cut and pry the zinc coating in a manner to attempt to lift and remove the coating. If the coating flakes or peels off the base metal so as to expose the base metal in advance of the knife point, the adherence is considered inadequate. Adherence evaluations carried out at edges or corners of parts, or removal of small coating particles by paring or whittling, are invalid.

2.4.8.4 Surface Appearance

There are certain requirements for the appearance, smoothness, or uniformity of the zinc coating. These requirements are covered in both ASTM specifications A 123 and A 153. If the coating has the required coverage and adherence, the galvanized coating should not be rejected on the basis of appearance only. If the molten zinc kettles are not regularly cleaned, excessive deposits of "dross" may appear on the galvanize surface. Such contaminants may be removed by vigorous wire brushing or light sanding, providing the required zinc coverage (thickness) is still maintained. Excessive dross may cause corrosion.

Many factors affect the finish and appearance of the zinc coating. In the hot-dip galvanized method, the temperature of the molten zinc bath, the cleaning (pickling) method, size, thickness, shape, geometry, original surface conditions, and chemistry of the steel part all may affect the final surface finish. High percentages of silicon and manganese in the parent steel may create accelerated grain growth of the deposited zinc. This often creates a gray mottled and very non-uniform appearance. Environmental restrictions now limit the use of certain fluxing agents which in the past provided better flowability of the molten zinc and resulted in a much smoother, cleaner appearance.

Large and long fabricated parts or those with unusual geometry may require “double-dipping.” The structure should be designed to avoid “double dipping.” Many of the galvanized kettles do not have sufficient depth, length, and width to submerge the entire part at one time. This requires that the one side of the part be first galvanized and then turned, and the remaining part be dipped in a second operation, “double-dipping.” This often results in a non-uniform surface appearance and an obtrusive over-lapping area of zinc. Unfortunately, this cannot be avoided when parts exceed the size to be entirely submerged in the zinc kettles. Most new hot-dip galvanized surfaces will have a “spangle” (shiny mottled appearance). In time, all galvanized surfaces will develop a more uniform dull gray appearance from weathering.

For steel parts that are fabricated by welding, it is important that all deposited weld slag and weld splatter be removed. The weld slag and spatter will not be removed by the acid cleaning treatment (“pickling”). Weld slag removal may require blast cleaning of the weld areas prior to galvanizing. Weld slag and spatter will have to be scraped off or ground off. Areas under the weld flux and splatter cannot be galvanized. Black deposits adjacent to welds after galvanizing indicate that the weld slag may not have been completely removed.

Contact surfaces of fabricated steel parts should generally be seal welded. Seal welding will normally be specified in the contract specifications or plans. The “pickling” acid may penetrate joints which are not seal welded. Entrapped acid may bleed out later and result in unsightly rust stains exuding from the unsealed joints. Such stains will have to be removed on new work; however, as the interior contact surfaces cannot be properly galvanized, serious hidden corrosion may proceed.

Oftentimes the geometry and design of the parts present awkward handling during hot-dipping; there may be “runs” or globular areas on the zinc coating or excessive pocketing of zinc in some areas. Pocketed areas over 15 mils should be treated with special caution and visual inspection. Unless these create an aesthetic problem, these are permissible if they have the required thickness and adherence. Such anomalies can be lightly sanded or filed, providing the required zinc thickness is maintained.

Mechanical galvanizing is achieved by rotating the small parts in a rubber-lined drum where powdered zinc is impinged and worked onto the steel surface by a gradation of small glass beads. This is not a chemical process. Subsequently, the control of zinc thickness and uniformity of appearance is easier to control. For our highway construction, mechanical galvanizing is often used for bolts, nuts, and washers. Caltrans requires that some high-strength fasteners and fastener components (TC bolts and direct tension indicators) be mechanically galvanized.

2.4.8.5 Special Precautions

The hot-dip galvanizing process requires stripping and cleaning (“pickling”) of the part by first using an acid medium. If the part is not baked in an oven, this may cause “hydrogen embrittlement” to develop in the steel. This is especially a problem with high carbon, high-strength steels, and formed (work-hardened) materials. Embrittlement makes it especially difficult to bend steel parts that are hot-dip galvanized without cracking. All parts formed must be bent prior to galvanizing. The Inspector should inspect bent areas closely for cracks on galvanized products.

Hot-dip galvanizers often place drain and vent holes in tubular sections which are to be galvanized. Also, closed tubular sections can create dangerous explosions during galvanizing due to the expansion of entrapped gases in totally closed spaces. Designers should detail such drain holes at locations suitable for design. Such holes when sporadically placed by the galvanizer can seriously reduce the design capacity of the part. The Inspector must be on the alert for unauthorized holes made by the galvanizer and inform his supervisor of this.

These internal stresses result from the original mill rolling and particularly shrinkage stresses produced from welds used in fabrication. The relieving of these stresses will cause galvanized members to distort, wrack, and lose their original dimension and shape after galvanizing. Excessive distortions will require straightening and oftentimes total rejection of the galvanized members.

Type of Material	Standard Specifications	ASTM/ AASHTO Specifications	Req. Coating Thickness (mils)	Remarks
Steel Shapes, Plates, Bars, Strips and Castings 1/8" (3.2 mm) thick or thicker	Sec. 75-1.05	ASTM A123	3.4 mils (0.141 µm) each side of part	HDG required after fabrication
Steel thinner than 1/8" (3.2 mm)	Sec. 75-1.05	ASTM A525, G210 HDG before fab. ASTM A123 HDG after fab.	3.6 mils total, both sides; 2.0 mils each side	HDG may be before or after fabrication
Iron and steel hardware, and bolts and nuts	Sec. 75-1.05	ASTM A 153 HDG ASTM B695, Mech. Galvanizing	Req'd. thickness varies based on thickness & diameter. Re: A153, Table 1	Bolts, studs, nuts, & washers may be mech. galvanized.
Steel metal for box beam signs (Sign Structures)	Sec. 56-1.02b	ASTM A525, G165 Pre-galvanized sheet	2.8 mils total, both sides	Zinc metallizing AWS C2.18 O.K.
Drainage Pipes (CSP, PMP, SPP)	Secs. 66, 67, 68, 69	AASHTO M 218, M219	3.4 mils total, both sides	Use CA Test 652 to determine thickness
Metal Beam Guard Rail	Sec. 83-1.02b	AASHTO M 180, Type I Coating	3.4 mils total, both sides	May be galvanized before or after forming
Misc. Products (pipe, wire, etc.)	Sec. 75-1.05	Varies – Type of product and end use determine requirements.		

Table 2-1. Specification Reference

2.4.9 Structural Fasteners, Bolts for General Applications, and Anchor Bolts/Threaded Rods

2.4.9.1 General

Requirements for structural bolts, bolts for general applications, and anchor bolts and threaded rods are covered in this section. Because there are so many types and grades of fasteners and fastener components and each has different requirements, the Inspector must first carefully review the contract specifications and plans. The appropriate version of the Caltrans Standard Specifications will generally reference the applicable ASTM, AASHTO, and ASME or ANSI specifications.

High-strength bolts, studs, and anchor bolts may be produced from medium carbon, low carbon-boron steel, or alloy steel that is quenched and tempered. Also, some high-strength bolts, and certain nuts and washers are manufactured from weathering steel. Requirements for nuts and washers suitable for use with particular bolts or studs are listed in the "Scope" Section of the appropriate ASTM fastener specification, and under Appendix X1 of the ASTM Specification A 563.

Commentary:
Each size, length, and grade of fasteners made from different heats of steel and different combination of lots of fastener components may be required to be identified, packaged, sampled, and tested as individual lots. A307 fastener assemblies, with the exception of non-headed rod anchor bolts, are exempt from sampling requirements. A307 fastener components must be identified by either manufacturer lot number or heat number.

2.4.9.2 Helpful References and Information about Fasteners

Key Reference Specifications and Standards for Fasteners: The following is a listing of fastener references for general and structural bolts, nuts, and washers and threaded rods and anchor bolts frequently specified in Caltrans contracts. These contain many requirements for various properties and dimensions. As a preliminary part of the inspection, the contract documents must always be reviewed to determine which specifications/standards have been referenced. Care must be taken to ensure that the appropriate reference documents are used in the inspection (i.e., documents in effect when the contract bid was awarded).

ASTM:

A 307 - Mild Steel Bolts, Studs, & Anchor Bolts (Grade C)
A 325 - High-Strength Fasteners for Bolted
A 449 - High-Strength Bolts, Threaded Rods, & Studs
A 354 - Quenched and Tempered Alloy Steel Bolts & Studs
A 563 - Nuts, Hex & Heavy Hex Head (Grade to match bolt)
A 194 - Grade 2H Nut (alternate for A 563, Grade DH)
F 436 - Hardened Washers for High-Strength Bolts
F 844 - Plain Washers for Mild Steel Bolts
F 959 - Direct Tension Indicators ("DTIs")
F 1077 - Marking Requirements for Fastener Products
F 1852 - Tension Control Bolt/Nut/& Washer Assemblies (TC bolts)
A 153 - Hot-dip Galvanizing (Class C)
B 695 - Zinc Coating by Mechanical Deposition (Class 50 Coating Weight)
A 722 - Prestressing Rod, Type II Deformed or Threaded

AASHTO:
M 314 - Anchor Bolts, Gr 36 or 55

ASME:
B1.1 - Unified Screw Thread Dimensions
B18.2.2 - Dimensions of Square and Hex Nuts
B18.2.6 - Dimensions of Structural Fastener Components (nuts, bolts, washers, and DTIs)

Note: Supplemental requirements for the above specifications may apply.

Important Contractual Documents for High-Strength Bolting: Two important contractual documents published by others are vital when inspecting high-strength fasteners. These are 1) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" (also called the **RCSC**

Specification) and 2) the **Structural Bolting Handbook** published by the Steel Structures Technology Center, Inc. Both of these are referenced in our Standard Specifications and job specials, and must be available, read, understood, and followed by both Inspectors and Contractor personnel who are responsible for installation or inspection of high-strength fasteners. The new version of the RCSC Specification (June 2000) may be accessed on and downloaded free from the RCSC website at www.boltcouncil.org. The previous version of the RCSC Specification (June 1994) may be purchased by calling 1-800-644-2400. The Structural Bolting Handbook contains lots of practical information about high-strength bolting and step-by-step procedures for doing preliminary tests on short and long bolts and DTIs, and may be purchased by calling 1-248-344-2910.

2.4.9.3 Packaging, and Package Marking

First, all fastener components for each production lot shall be checked for proper packaging and package marking according to requirements in applicable ASTM documents. In most cases, hot-dip galvanized components of high-strength fastener systems of a particular assembly lot must be shipped in the same container; there may also be a requirement to preassemble fastener components prior to shipment (see ASTM F 1852 for tension control fastener assemblies). Check applicable ASTM specifications for specific packaging and package marking requirements.

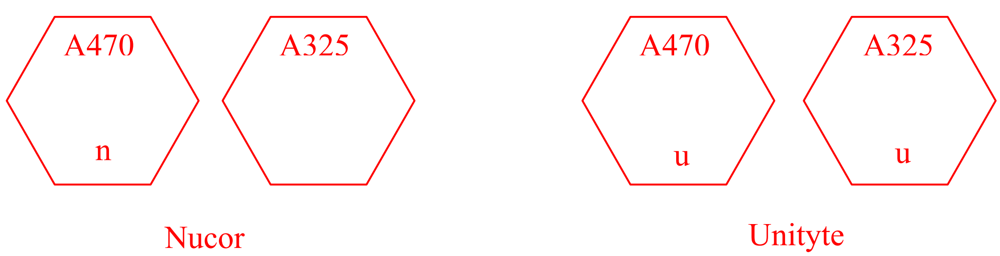
2.4.9.4 Test Reports and Certification Required

The Contractor is responsible for providing a copy of all required test reports to the inspector. The inspector should carefully check that at least one of the fastener components match the nominal values listed on the contractor's submitted paperwork. These required reports are outlined under ASTM sections having varied names, including "Certification", "Reports", "Number of Tests and Retests", and others. Inspectors shall verify that all required test reports (to be submitted by the Contractor at the time of inspection and sampling) are present and are complete, legible, and appropriate for the size, length, type, and grade of fastener component being sampled/inspected. Procedures that the Manufacturer shall use for performing the rotational capacity (RoCap) test are included in the job specials or Standard Special Provisions. "Buy America" certification shall also be provided when required by the contract. A copy of all required test reports shall be forwarded to the Structural Materials Testing Branch of the Office of Structural Materials in Sacramento for evaluation and filing, along with the completed TL-0101 and samples. Upon completion of sample collections, the QA inspector will copy all supporting documentation of samples including the TL-102. One set of the copies will go to the inspector's taskleader for filing at the branch office (these will be used for release later after QA testing is complete). The other copy of the paperwork will go with the samples to the testing lab. All samples will be delivered to the Sacramento Translab. The TL-102 will be put on the common server, in the "Bolt Samples/Incoming Samples" folder. Once testing is complete and the inspector has received the faxed QA test results, the inspector will access the server again and locate the modified TL-102 in the "Bolt Samples/Tested Fasteners" folder. The inspector will then print out the "TL-29" and the "Inspector's Sample Sheet". Careful attention should be paid to imputing the correct release date on the form prior to printing. A copy of the TL-29 and the Inspector's Sample Sheet should be included in the Orange tag pouch adhered to the fastener container. If the TL-101 is utilized for the samples, then traditional TL-101 protocol will be used.

2.4.9.5 Visual Inspection and Product Marking Requirements

Visual inspection shall consist of verifying that 1) fastener diameter, length, and grade are correct as required in the contract, and 2) a Manufacturer's unique logo, type, specification code, and any other marking are present as required in the "Product Marking" section of the applicable ASTM document(s). Bolts are usually marked on their heads by raised or depressed markings, as permitted by the applicable ASTM specification. One end of threaded studs and rods is required to be permanently marked with the Manufacturer's logo and grade of steel. Mild steel anchor bolts (ASTM A 307 and AASHTO M 314) are required to be color-coded on the end which will project from the concrete, to designate a particular steel grade. The required color (green, blue or yellow) designates either ASTM A 307 grade C, or AASHTO M 314 grades 36 or 55 and must be applied by the Manufacturer. Other optional permanent raised or depressed markings may also be used as allowed in the appropriate supplementary specification. Marking requirements will vary with the particular specification and type of steel furnished so it is important that the Inspector review the contract documents and specifications closely. Some mild steel anchor bolts will be welded and supplementary weld requirements must be met. Depending on which specification (ASTM or AASHTO) anchor bolts must meet, the type of steel used, the maximum carbon equivalent and chemistry in S1 Supplementary requirements will vary. Special white marking or paint striping that designates satisfactory weldability may be required by either ASTM of AASHTO, and must be applied by the Manufacturer.

Dimensions of fastener components should be checked to make sure they comply with requirements in the appropriate ASTM specification, or ASME or ANSI standard. Zinc coating, if required, shall be inspected for proper type (either hot-dip galvanized or mechanically deposited) and sufficient thickness. All inspectors should also be capable of differentiating between Unityte and Nucor nut markings to ensure that correct supporting documents have been submitted by the contractor (see figure below).



The presence of special dyed, dry lubrication on zinc-coated nuts or cap screws shall be verified, when required. Anchor bolts must be furnished with two nuts (top and leveling) and two washers, one each to be placed directly above and below the base plate. Overall length of anchor bolts shall be checked, and the length of galvanizing on the exposed ends of anchor bolts shall be verified to make sure it is correct. Tails on anchor bolts, when required, must be bent to an acceptable radius and be the proper length. For some threaded fasteners, zinc coating by the mechanical deposition process may be required (e.g., zinc-coated TC bolts and DTIs). With zinc coating by the mechanical deposition process, the zinc layer is more uniform, and requires a smaller oversize pitch diameter in nut threads. However, the zinc coating is generally thinner than with hot-dip galvanizing, and may chip off easier during rough handling or installation. The thickness of the zinc coating thickness should be verified with a magnetic thickness gage. For bolts zinc coated using the hot-dip galvanizing or mechanical deposition process, the pitch diameter and dimensions of finished, coated threads shall comply with limits in applicable bolt specifications. The mating nut or internally threaded hole must be tapped oversize in accordance with procedures and complying with tolerances listed in ASTM A 563 to make allowance for the zinc layer on the bolt threads. When nuts are hot-dip galvanized, all tapping is required to be performed after galvanizing. Different plug gages are available for checking pitch diameters of internal threads of standard (black) and zinc-coated nuts with overtapped threads. Lubrication on threads of zinc-coated cap screws, when specified, and on zinc-coated nuts used with zinc-coated high-strength fasteners is required to be dyed, and clean and dry to the touch. The colored dye (e.g., blue, greenish-blue, or pink and black) in lubricant of zinc-coated fasteners indicates that some type of special lubricant has been applied, but does not guarantee the proper amount or acceptable quality. Plain steel fastener components (including bolt, nut, and washer) are coated with an oily water-soluble lubricant by the Manufacturer. All lubricant that is present on fasteners and has been applied by the Manufacturer must not be removed or altered, until tensioning and final inspection of installed fasteners have been completed. Furthermore, fastener lubricants must utilize visible dye ingredients.

2.4.9.6 Fastener Sampling and Quality Assurance Sample Size Required

Each production lot or assembly lot of fastener components or fastener systems (bolts, nuts, washers, and DTIs) shall be check sampled. The Structural Materials Testing Branch of the Office of Structural Materials will perform quality assurance testing of fastener samples and evaluation of manufacturer's test reports. Complete A 325 fastener systems and F 1852 TC fastener assemblies, consisting of bolts, nuts, and washers having the same assembly lot or rotational capacity lot number, shall be sampled by the Engineer or QCM, when allowed, and mailed to the Structural Materials Testing Branch as a matched assembly – one lot # and TL-0101 or an Electronic Bolt Form, TL-102 to each assembly lot. A307 non-headed anchor bolts shall also check sampled. A307 fastener components shall be random sampled on a periodic basis. There is no requirement for A307 fastener components, other than non-headed anchor bolts, to be sampled for each production lot.

For each lot of fasteners or fastener components, the appropriate sample size required for quality assurance testing of fasteners is specified in the following table and is based on sample size requirements in ASTM Specification F 1470, with adjustments and reductions deemed appropriate by the Structural Materials Testing Branch:

Caltrans Fastener Sampling Table

LOT SIZE*	TOTAL SAMPLE ** SIZE PER LOT									
	Source from: a) New foreign and domestic manufacturers, and b) Established foreign and domestic manufacturers with previous rejections.					Source from Established foreign and domestic manufactures with past satisfactory quality.				
	Proof Load	Wedge Tensile	Rockwell Hardness	Galvanized Thickness	Dimension Verification	Proof Load	Wedge Tensile	Rockwell Hardness	Galvanized Thickness	Dimension Verification
2 TO 15	3	3	3	3	3	1	1	1	1	1
16 TO 25	4	4	4	4	4	1	1	1	1	1
26 TO 50	5	5	5	5	5	1	1	1	1	1
51 TO 90	7	7	7	7	7	1	1	2	3	3
91 TO 150	8	8	8	8	8	1	1	2	3	3
151 TO 280	9	9	9	9	9	1	1	2	3	3
281 TO 500	12	12	12	12	12	2	2	3	5	5
501 TO 1,200	12	12	12	12	12	2	2	3	5	5
1,201 TO 3,200	12	12	12	12	12	2	2	3	5	5
3,201 TO 10,000	12	12	12	12	12	3	3	4	7	7
10,001 TO 35,000	16	16	16	16	16	3	3	4	7	7
35,001 TO 150,000	16	16	16	16	16	3	3	5	8	8
150,001 TO 500,000	16	16	16	16	16	4	4	6	10	10
500,001 +	20	20	20	20	20	5	5	7	12	12

* Lot size shall be defined as the total number of fasteners from one production or assembly lot or shipment which is available for sampling and inspection at a particular time. Number of samples collected by inspector is equal to the number for dimension verification.

** One sample is defined as one of each fastener component (i.e., bolt, nut, washer, DTI, cap screw, etc.) that make up a fastener assembly.

Note:In some cases, there may be a limited supply/number of fastener products available/furnished for a particular job or application, or fasteners may be extremely large or expensive. In these cases, it may be necessary and acceptable to judge the quality of fasteners based on satisfactory results from 1) a thorough visual inspection and 2) acceptable data contained in certified test reports, 3) the recent track record of fastener quality if fabricated by a well-established Manufacturer, and 4) positive results from non-destructive testing to determine important mechanical properties may be done to verify important parameters without causing irreparable damage to the limited supply of components. Specific questions on sample sizes required for quality assurance testing done by the laboratory should be referred to the Structural Materials Testing Branch Chief at (916) 227-7253.

2.4.9.7 Reporting

Once positive test results and a recommendation for approval of a fastener lot from the laboratory of the Structural Materials Testing Branch has been received by the sampling inspector, fastener components/assemblies may be tagged and released. Record the number of assemblies, consisting of the same combinations of bolts, nuts, and washers, that have been sampled, tested, and released as assemblies. Report the number of assemblies released, diameter and lengths, specifications for bolts, nuts, and washers, or other fastener components, indicate finish (black, hot-dip galvanized, or mechanically deposited zinc coating), and any thread lubricants on Report of Inspection TL-0029 that is generated in conjunction with the TL-102. In addition, the "inspector's Sample Sheet" should also be printed out and put in the orange tag pouch for use by the Structures Representative who receives the fasteners at the jobsite. Each keg or container of fasteners should have an orange tag pouch affixed to it indicating the lot number associated with the release.

Individual anchor bolts and rods shall be released as assemblies consisting of the bolt, nuts, and washers. Dimensions of hooks or tails on anchor bolts and rods bent or formed to at least the minimum radius specified for the bar diameter shall be reported on the TL-0029.

2.4.9.8 Precautions

Most high-strength fasteners and fastener components are heat-treated and may be made from alloy steels or carbon steels having a medium to high carbon content. <u>Structural welding should never be permitted on high-strength fasteners or components</u>. (Occasionally tack welding on the exterior edges of nuts, bolt heads, or washers may be specified but should be avoided if possible.) Welding of any type should not be done on shanks of high-strength fasteners.

Heat straightening of high-strength anchor bolts or rods is not allowed. On the other hand, mild steel bolts (A 307, grade B) and anchor bolts (either ASTM A 307 grade C or AASHTO M 314 grades 36 or 55) which comply with S1 Supplemental Specifications, may be successfully welded, cold bent, or heat-straightened when the appropriate AWS code is followed. Welding on fasteners or fastener components should only be permitted on clean black steel following rules in the appropriate AWS code, and when approved by the Engineer. It should never be done on a galvanized, lubricated or oily surface. Note that maximum carbon equivalent levels permitted in S1 Supplementary requirements in ASTM and AASHTO specifications for weldable anchor bolts may be different, so pay attention to which specification the anchor bolts must comply, review the permitted maximum carbon equivalents (C. Es.) and chemistry in the S1 supplementary requirements, and compare with the C.E. and actual chemistry shown in the mill test reports for components intended to be welded.

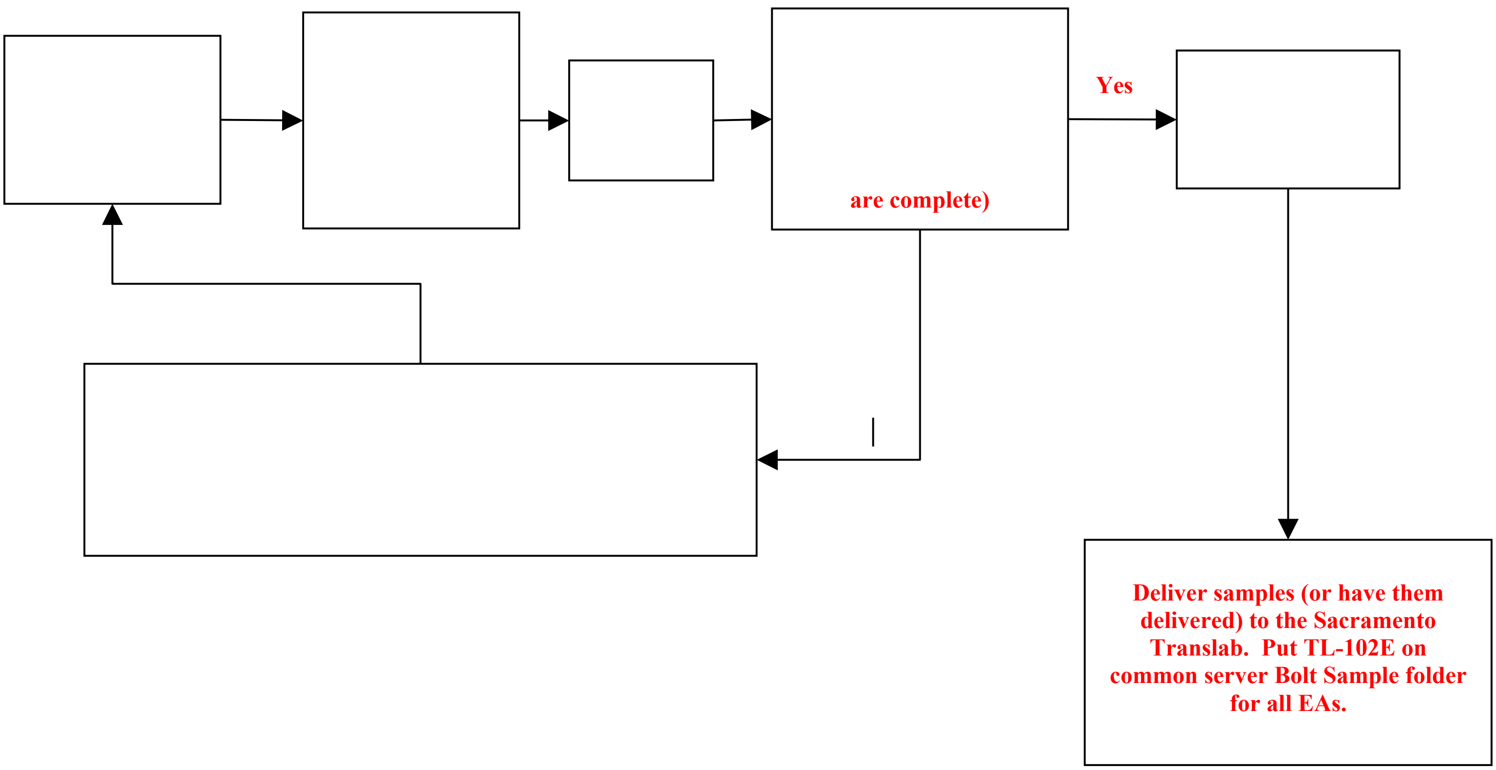
In some instances, high-strength rod is specified for earthquake retrofit designs and high-strength anchor bolts may be specified for anchorages when a high earthquake loading is anticipated. ASTM A 449 or A 354 (grades BC or BD) threaded rod or A 722, Type II deformed or threaded prestressing rod may be specified by the designer for this purpose. Nuts approved for use with these high-strength rods are those recommended in the appropriate rod/ bolt specification. Zinc coating (standard hot-dip galvanizing) of A 354 grade BD or A 722 high-strength rod is presently not recommended, as hydrogen embrittlement may result. Painting of rods having a minimum tensile strength greater than 150 ksi may be acceptable, however no cleaning process should be used that will introduce hydrogen into the steel.

Beware that there are many foreign bolts being sold in the United States that may not be in full compliance with ASTM or AASHTO specifications. Improper heat treatment and chemistry can cause many serious problems that are often present in cheaply made, foreign fasteners.

Bolt and stud suppliers may be required to furnish a Caltrans-approved thread locking system, consisting of a cleaner, primer, and anaerobic adhesive for securing zinc-coated nuts to male threads of zinc-coated studs or bolts. Anaerobic adhesive systems presently appearing on the Caltrans approved list have been validated only for zinc-coated fastener systems having a nominal stud diameter from 7/8” to 1-3/8” and which have a moderate clearance between the male and female threads. These systems are not satisfactory for black fasteners with small thread clearances, or for stud diameters larger than 1-3/8” with extremely large thread clearances.

Technical questions on bolts and related components should be referred to the Structural Materials Testing Branch at (916) 227-7253 or the appropriate SMR.

Process for sampling fastener assemblies:



2.5 TIMBER

2.5.1 General

Timber inspection includes treated and untreated timber, i.e.: structural timber, laminated box posts, fence and guardrail posts, and other timber and lumber products. The Office of Structural Materials is not responsible for timber not to be included in the final structure, such as false work structures and concrete formwork.

2.5.1.1 References

- Caltrans Standard Specifications Section 57
- Contract Special Provisions and/or Contract Plans
- AWPA American Wood Preservers Association
- ASTM American Society for Testing Materials
- WCLIB West Coast Lumber Inspection Bureau – Grading Standard No. 17
- WWPA Western Wood Products Association – Grading Rules
- ALSCA American Lumber Society of California
- ANSI American National Standards Institute

2.5.1.2 Inspection

All lumber shall be grade stamped. Stamps shall identify the wood supplier, type of wood and year graded. A certified grading certificate shall be supplied.

Treated wood shall have I.D. tags attached to each bundle shipped. Tags shall include the treater's registered I.D., species of wood, treatment applied and the year treated. These tags shall be supported by a certified treatment report including an assay report.

Visual inspections should be made for grade, dimensions, incising, chemical treatment, general condition and cleanliness of the surface as required per type and use of wood product. (see attached checklist)

If the materials appear satisfactory, the inspector should be able to rely on the supplier's certificate of compliance, purchase order, treater's certification and treatment report including an assay test report. If it becomes obvious these documents cannot be relied upon, the material should not be accepted and the inspector should consult his/her dispatcher.

A TL-6034, Source Inspection Report will be used with the following information: Quantity, size, lumber specie, grade and type of preservative treatment used. Attach to this report copies of the supplier's Certificate of Compliance containing a complete description of lumber/timber and/or subcontractor referenced above.

2.5.2 Timber piles

2.5.2.1 General

Timber pile requirements are listed in the Contract Special Provisions or as specified in Section 49-2 of the Standard Specifications. Any treatment of piling is specified in the contract special provisions.

Timber piles are generally supplied by companies specializing in their fabrication.

2.5.2.2 References

- Caltrans Std. Spec. – Section 49-2 and Section 58
- Contract Special Provisions
- ASTM
- AWPA

2.5.2.3 Inspection

A moisture reading should be taken and a certified report issued as per Standard Specifications, Section 49-2.03, Paragraphs 4 and 6.

Visual inspection will consist of compliance with overall quality, dimensions, straightness and verification of preservative treatments as per detailed in the Contract Specifications. Any steel strapping shall also be inspected for conformance.

Each shipment of piles accepted for use on a Caltrans project shall include a certificate of compliance from the supplier stating the number, lengths, size, specie and treatment, if applicable, of pile shipped. A preservative treatment report, including an assay report if chemically treated, should also be attached to the TL-6034 Source Inspection Report.

The TL-6034 shall include a detailed description of the timber piles and all Certificates and reports shall be attached.

TIMBER INSPECTION CHECKLIST

Project Name Contract No:
Supplier SMR:
Location Resident Engineer:

TIMBER/LUMBER INSPECTED:				
☐ Structural Timber	☐ Laminated Box posts	☐ Fence posts, square	☐ Fence posts, round	
☐ Guard rail posts	☐ Guard rail blocks	☐ Timber piles	☐ Sign posts	
LUMBER:				
☐ Douglas Fir	☐ Hem-Fir	☐ Redwood	☐ Port Orford Cedar	☐ Southern Yellow Pin
☐ **OTHER:**				
LUMBER GRADE:				
Structural	☐ No. 1 Heart	☐ No. 2 Heart	☐ No. 1 free of heart center	☐ No. 2 Joists & Planks
Structural Light Framing	☐ No. 1 free of heart center			
Select Structural	☐ No. 1 Posts & timbers, free of heart center			
Construction Light Framing	☐ No. 1	☐ No. 2		
Timbers	☐ No. 1 No. 1			
☐ Laminated Plywood Spec	☐ ANSI Class 5 or larger			
TREATMENT:				
☐ Kiln dried	Moisture content _______% (average of three readings)			
☐ Seasoned	Moisture content _______% (average of three readings)			
☐ Creosote	☐ Creosote – coal tar solution	☐ Creosote petroleum solution (50-50)		
☐ Pentachlorophenal in hydrocarbon solution (Penna)				
☐ Copper naphthenate (CA)	☐ Chromated Copper Arsenate (Southern Yellow Pine only)			
☐ Ammoniacal copper arsenate (ACA)	☐ Ammoniacal copper zinc Arsenate (ACZA)			
☐ Other ____________________				
ATTACHED CERTIFICATIONS AND REPORTS:				
☐ Certificate of Compliance (supplier)	☐ Mill Certified Grading Report			
☐ Certificate of Treatment	☐ Certified Treatment Report (charge report)			
☐ Assay Report	☐ Certificate of Moisture Content			

Visual Inspection: (Defects or flaws in materials affecting more than 10% of total inspection could be cause for rejection. Refer to applicable specifications for more details.)		
Wood grader's stamp	☐Yes	☐No
Incising (if required)	☐Yes	☐No
Dimensions within tolerance	☐Yes	☐No
Wood treatment tags	☐Yes	☐No
Cracks running continuously through wood end to end	☐Yes	☐No
Cracks running continuously through wood side to side	☐Yes	☐No
Large Loose knots in clusters	☐Yes	☐No
Medium to large areas of soft or rotting wood	☐Yes	☐No
Signs of warping	☐Yes	☐No
Signs of twisting	☐Yes	☐No
Large lengths of waning	☐Yes	☐No
Excess deposits of preservative on surface	☐Yes	☐No
Preservative still dripping or wet, not allowed by EPA	☐Yes	☐No

Inspected By:	Quality Assurance Inspector	Date:
Reviewed By:	Title:	

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2.6 SEALING AND WATERPROOFING PRODUCTS

2.6.1 General

2.6.1.1 Scope

This section covers products to prevent water from entering a structure, under such names as: methacrylate resins, silane sealers, waterproofing, primer, mopping asphalt, waterproofing fabric, and asphalt plank. Rubber waterstop is covered in Concrete Reinforcement and Accessories (2.2). Asphalt-latex emulsion joint sealer is discussed in the same section. Sub-sealing asphalt is covered in "Bituminous Products" (2.7).

There have been many new product developments. Most of the newer waterproofing products are specified in the contract special provisions.

2.6.1.2 General Remarks

Inspection of such products consists of sampling, testing, and visual inspection as required.

2.6.2 Waterproofing Materials

Refer to Standard Specifications Section 54 and the contract special provisions.

2.6.2.1 Sampling and Testing

Take one-quart sample from each batch proposed for State use and forward to the Office of Structural Materials for tests per specifications. Indicate lot number and batch number and other pertinent information on TL-0101.

2.6.2.2 Shipping

Shipment to specific contracts will be made by vendor from tested and approved batches. Vendor must mark batch number and lot number on all containers.

2.6.2.3 Reporting

Record quantities in volume. Report shipments to contracts on Form TL-0029.

2.6.3 Waterproofing Fabrics and Membranes

Review the contract plans and special provisions to determine the specification and end use of the fabrics and membranes to be inspected. Standard Specifications Section 54 Waterproofing and Section 70 of the Standard Specifications govern these materials for waterproofing concrete and coating pipes. There has been a constant improvement in the technology of these types of materials and the Inspector must be on the alert for these specification changes. If proprietary materials are specified, visual inspection and manufacturer's certificates of compliance are sufficient for acceptance.

2.6.3.1 Sampling and Testing

Take at least one sample (1 m by full width) for testing from each identifiable production lot. Samples should be rolled and not folded.

2.6.3.2 Shipping and Reporting

Vendor may ship to specific contracts from tested and pre-approved stock. Note the "Green Tag" number on your Inspector's Shipping List. Check materials to be released to ensure they are properly packaged and, when required, they have the manufacturer's marking. Report the number of rolls, type of material, and area per roll on Report of Inspection Form TL-0029.

2.6.4 Epoxies

2.6.4.1 General

For standard epoxies refer to Section 95 of the Standard Specifications. Epoxies are commonly used for repairing concrete and bonding anchor bolts and rods. Special requirements will be listed in the special provisions.

2.6.4.2 Inspection

Sample each batch of both Components "A" and "B" which when mixed will make up the finished batches of epoxy. Normally, a quart each of "A" and "B" will be sufficient. Take samples from properly labeled containers. Each container must be labeled with the State Specification Number, manufacturer's name, batch number, date of manufacture, Component A or B, State Lot Number under which the epoxy is sampled and approved, and directions for use. The entire batches of acceptable material will normally be released as pre-approved Caltrans stock, which can be identified by the Batch Number and the State Lot Number.

2.6.4.3 Reporting

Report quantities in volume and indicate the individual container sizes on Form TL-0029. List the specification number, batch number, and whether rapid or standard set, when applicable.

2.6.5 Deck Sealants and Overlays (HMW Methacrylate Resins, Polyester Concrete)

2.6.5.1 General

These are highly specialized materials, and requirements will normally be listed in the contract special provisions. OSM will respond to Form DC-CEM-3101, on projects with HMW Methacrylate by issuing a Notice of Material to be Inspected, Form TL-28, informing the Contractor to send samples to the Concrete Lab at least 14 days prior to shipping along with available QC documents. The Resident Engineer (RE) may sample at the job site.

2.6.5.2 Testing and Reporting

The Concrete Lab will perform QA tests on samples sent by the manufacturer and notify the RE and the manufacturer of the test results.

2.6.5.3 Inspection and Reporting

These materials are quite volatile and can create toxic reactions. Care must be exercised during sampling and shipping. Special containers may be required for shipping. Refer to Material Safety Data Sheet (MSDS) related to sampling and shipping the material.

2.6.6 Engineering Fabrics (Reinforcing, Filter, Geocomposite Drains, Geomembranes)

2.6.6.1 General

There are many engineering fabrics with varying purposes used in highway construction. These are specified in the contract special provisions, along with the sampling and testing requirements. As these requirements are constantly changing, the Inspector must review the contract special provisions for each inspection assigned.

2.6.6.2 Sampling and Inspection

Generally, take one sample for each 50 Rolls, 1 m x roll width. Take sample so the exposed portion of roll is not used. Do not fold or crease sample as this will cause erroneous tensile test results. Obtain Certificate of Compliance from manufacturer. Be sure each roll of fabric is packaged with specified ultra-violet protective wrapping and is marked with manufacturer's lot number.

2.6.6.3 Reporting

Report quantities in area on form TL-0029. List manufacturer's batch number.

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2.7 PIPE COATINGS

Bituminous coating for pipe is sampled by Inspectors at the plant where the coating is applied. Corrugated metal pipe is coated in accordance with AASHTO M190 (Re: Sec. 66-1.03. Welded steel pipe coatings are governed by AWWA C203 (Re: Section 70-1.02). Welded steel pipe may be both coated and wrapped with asbestos felt. Final acceptance of coatings will be dependent on acceptable test results of the coatings or certifications of the coating and wrapping. The required coating thicknesses must be verified by spot checking. "Holiday" testing is often required to ensure that there are no bare spots in the coating.

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2.8 PRECAST CONCRETE PRODUCTS

(Refer also to Part 3, Prestressed Concrete)

2.8.1 General

2.8.1.1 Scope

Included in this section are various precast concrete products, such as reinforced and non-reinforced concrete pipe, porous concrete pipe, concrete manholes, flared end sections, concrete lighting standards, sound walls, survey monuments, drop inlets, median barriers, raised traffic bars, etc. Precast prestressed concrete products are covered in Part 3 of this manual. Some of these products also fit into general categories covered elsewhere in this manual. In these cases, cross-referencing is employed as needed.

2.8.1.2 General Information

2.8.1.2(1) Procedures

The inspection procedure will include all or part of the following, depending on specification requirements for the product. Review the contract special provisions and plans to determine the correct requirements. Concrete requirements may be listed in Standard Specifications Section 90 with frequent references to AASHTO specifications, particularly for precast concrete pipe products.

1. Sample all concrete component materials for required tests to determine compliance with material specifications. Air entrainment and other admixtures, approved freeze-thaw aggregates, and non-deleterious aggregates may also be specified. Sample frequency and required size of samples shall be as directed by the supervisor.

2. Steel reinforcement type and specifications must be in accordance with the specification requirements. Certified mill test reports must be supplied for all steel. Check sampling of steel shall be performed as specified. Any welding performed shall be evaluated in accordance with the governing specification.

3. The concrete mix designs for precast concrete products will generally not need the Resident Engineer's approval, particularly standard products governed by the AASHTO specifications, such as concrete pipe, manholes, etc. Mix designs of established prestress plants do not need the Resident Engineer’s approval (See Standard Specifications Sec. 90-2.01).

4. Observing the manufacturing processes, such as mixing, placing, tamping, curing, etc., as necessary to assure satisfactory quality and compliance with specifications.

These observations will be conducted on a selective schedule, based on the manufacturer's production volume and past history of test performance.

5. Sampling and testing the finished product, or witnessing tests thereon, will be at the frequency stated in the applicable specification or as directed by the supervisor. Compressive strength requirements will need to be verified by the fabrication and testing of test cylinders from representative concrete, unless concrete is specified by cement content or performance testing, such as the D-Load test for concrete pipe. Testing of test cylinders may be witnessed at manufacturer's Laboratory or sent to our Laboratory for testing.

6. Inspect the finished product for freedom from defects such as cracks, rock pockets, and other consolidation defects and compliance with dimensional and marking requirements.

7. Certain concrete products may require markings which identify the manufacturer, date of casting, and the concrete strength grade (e.g. pipe class, D-Load, etc.).

2.8.1.2(2) Cement

Requirements for Portland cement are listed in Section 90 of the Standard Specifications with any special requirements listed in the contract special provisions. In addition to the check sampling for required tests, the cement manufacturer must provide a Certificate of Compliance. Type II Low Alkali cement is normally specified; however, for increased sulfate resistance, Type V cement and a pozzolan additive may be specified. The special provisions for each contract to be inspected must be reviewed and where special cements or additives are specified, preliminary test samples should be taken, well in advance of actual production.

The manufacturer is also required to submit a Certificate of Compliance (Form TL-0543), certifying that the cement used complies with the specifications. Samples shall be at least eight pounds taken in accordance with Section 8-02-9 of the Construction Manual. Fill out Form TL-0518 and forward it to the Transportation Laboratory with the sample. Use the supplied plastic sample bags. <u>Cement samples must be shipped in double plastic bags and the special sample box to ensure safe delivery to the testing laboratory.</u>

Concrete for projects at higher elevations may require aggregates meeting freeze-thaw requirements and require a minimum air content as a protection against freezing.

2.8.2 Reinforced Concrete Pipe (RCP)

2.8.2.1 General

Requirements are listed in Section 65 of the Standard Specifications and the special provisions with any special details in the contract plans. General requirements are referred to AASHTO Designation M 170 and M 207, circular and elliptical sections. Verify the requirements for steel reinforcement, aggregate, cement type, and crush test (D-Load) before performing inspections. The D-Load requirement for the same diameter pipes may vary dependent on the height of fill D-Load testing must be in conformance with the reference AASHT0 specification. Pipe may be manufactured by the Direct Design Method (Sec. 65-1.01A(2) in which case, special precautions must be exercised by the Inspector.

2.8.2.2 Sampling and Testing (Materials)

All concrete materials must be sampled and tested in accordance with reference specifications. Sample concrete materials (aggregates, cement and admixtures) at least every 3 months or as otherwise directed the supervisor. Cement and aggregates must conform to the requirements of Section 90-2. Obtain manufacturer's certificates of compliance for cement and the pipe producer's Certificate of Compliance for cement (Form TL-0543) for each shipment.

The gaskets for rubber-gasketed joint pipe shall be certified by the manufacturer as to compliance with ASTM C 443M. When lubricants are used, the lubricant shall be that recommended by the gasket manufacturer. Samples should be submitted for tests for each supplying manufacturer on an annual basis.

Pipe manufacturers have the option of supplying pipe in accordance with the Direct Design Method, Sec. 65-1.02A(2). This requires the submittal of shop plans. Additionally, this requires trial batch testing of the proposed concrete mix design and the sampling and testing of concrete for each work shift.

2.8.2.3 Pipe Reinforcing Steel

Deformed bar steel may be certified at the source (if under our inspection control) or accepted on mill test reports. Most RCP use welded wire cages for reinforcement. Take random check samples of wire and wire mesh at 3-month intervals or as instructed by Supervisor for each supplying steel mill. Cages are usually rolled from pre-manufactured wire mesh to the required diameter and lap spliced by welding. There are also cage machines which are fed steel wire and automatically weld the cages to the required finished dimensions. Representative samples of circumferential weld splices in pipe cages must be submitted on a quarterly basis. Such tests are used to verify the weld procedure and welder. AWS Welding Codes do not govern the cage welding. Obtain copies of certified test reports and domestic certification for all steel reinforcement. Verify the minimum cross sectional area of steel reinforcement per linear foot of pipe as required by the governing AASHTO specification.

2.8.2.4 Inspection of Fabrication

Check the design, fabrication, and placing of the reinforcing cage and the concrete, including the placing, vibrating, tamping or spinning of the concrete. Steel cages and rings must be accurately placed and held in position with acceptable spacers and positioners.

Reinforcement cages may be placed in a circular shape concentric with the pipe or the reinforcement may be placed in an elliptical shape with the minor axis in the vertical position. A positive method of locating the axes of the elliptical steel cages must be provided.

See that steel forms and cores are in good condition as they affect dimensions and finish of the pipe. Verify that steel forms are not stripped before the concrete has attained its initial set. Also see that the curing method is as specified. Steam curing is the most commonly used method as it produces higher earlier strength. As a rule, steam curing is performed only over night. Some smaller plants may still use water curing. The curing method must be uniform for the pipe lot.

If the manufacturer proposes use of designs other than those specified, approval must be obtained through the Office of Structural Materials and Resident Engineer before acceptance. For certain special type pipes, approved shop detail drawings are required. Joint designs must conform to the joint performance requirements and details of Standard Plans Sheet D97H. Most of the standard joint designs used by established pipe manufacturers conform to current requirements; however, if in doubt, the joint details should be submitted to the Resident Engineer for approval.

2.8.2.5 Testing of Pipe

2.8.2.5(1) General

In lieu of compressive strength testing of concrete test cylinders, pipe designated by Class, except for the much larger diameters, are subjected to a crush test (D-Load) which is a performance test of the manufactured pipe. Read carefully all applicable specifications for the crushing load test (D-Load). Manufacturers shall furnish all necessary testing equipment and manpower for performing tests, as required by the applicable AASHTO specifications.

2.8.2.5(2) Sampling

Before selecting a section of pipe for D-Load test, conduct a close visual inspection of the pipe stockpiled for shipment for workmanship. Additionally, each pipe section must have all the required markings (Note: Pipe with elliptical cages must be striped at top and bottom of minor axis to ensure proper placement in the trench and during the D-Load test). If 10% or more of the sections fail visual inspection, this would indicate that the manufacturer is exercising inferior quality control. Further inspection and testing should be discontinued until the stockpile is resorted (“culled”).

If the overall quality of the stockpiled pipe is satisfactory, select the required number of pipe sections for testing sections (three sections of pipe for each size and class of pipe). Additional specimens, up to 2% of the total footage represented, may be tested, depending on the size of the order, specification requirements. Large quantities of pipe will not be manufactured on the same days. The general policy is to select from pipe that has been most recently produced, as the "greenest" pipe theoretically have the lowest concrete strength.

2.8.2.5(3) Testing Machine and Other Test Equipment

See that the D-Load testing machine complies with the 3-Edge bearing requirements specified in AASHTO T 33. Refer to ASTM E 4 for recommended maximum limits for intervals between calibrations of testing machines (1 year when in constant use, two to three years when in intermittent use).

A certificate of calibration by a public agency (city, county, etc.), a competent commercial laboratory, or other qualified agency will be satisfactory. Also check equipment used for transfer of load by the 3-edge bearing method. Note particularly the spacing of bottom bearing strips. In lieu of the plaster of Paris fillets permitted in AASHTO T 280, rubber strips are normally used to take up inequalities in the pipe. The upper bearing block should be a rigid hardwood block or equivalent steel beam under which a resilient filler (hard rubber strip, cement or sand layer) is used to take up inequalities in pipe to insure uniform loading.

2.8.2.5(4) Test Procedure (D-Load)

Test pipe in accordance with current specification and these instructions. For pipe 0.6-m diameter or smaller, the test specimen need not be tested to the actual crack required, provided the pipe is subjected to a load equivalent to the ultimate test load. The "D-Load" requirement will be expressed as load per linear length of pipe per diameter. Make necessary computations to determine total required D-load, based on diameter and length. Check all computations carefully before starting test. Check calibration chart of machine for gauge readings corresponding to required total loads. The specified pipe Class determines the required D-Loading. Use the following table to determine the D-Load requirements for the various classes, diameters, and pipe section lengths:

D-Load Table (RCP)

Class	D-Load to produce .01" (0.3 mm)Crack			D-Load to produce Ult.Failure		
I	800	lbs.	(40.0*)	1200	lbs.	(60.0*)
II	1000		50.0	1500		75.0
III	1350		65.0	2000		100.0
IV	2000		100.0	3000		150.0
V	3000		140.0	3750		175.0

- Newton's per linear metre per millimetre of diameter

Example: Req'd. D-Load = Diameter (in.) ÷ 12 x Length (ft.) to produce 0.01" crack

= Diameter (mm) x Length (m) to produce 0.3-mm crack

Ensure that requirements for the 3-Edge bearing test are followed and hydraulic testing jacks have been calibrated. Have available a ruler or scale for measuring length of crack, a feeler leaf gauge for measuring when specified crack width occurs, and a suitable notebook for recording data.

Proceed to witness load testing, which shall be performed per the applicable specifications. Note and record load at which hair crack appears, load at which required width of crack appears (or maximum load applied), if taken only to just above specified D-Load, and breaking load, when applicable. For circular pipe, the first cracks will appear at the top and bottom inside surfaces; whereas, for elliptical shaped pipe, the first cracks will appear on the outside surfaces at 3 and 9 o'clock. The machine operator will usually call off increments of load. Check his readings occasionally, also watch behavior of pipe under load. The extent to which an individual is tested will depend somewhat on the judgment of the Inspector. Decision as to the number of pipe sections tested to destruction will require the exercise of judgement on the part of the inspector. Samples for absorption tests are taken from pipe tested to destruction. Therefore, the Inspector shall make sure that sufficient tests to destruction are performed to provide reasonable assurance that the product complies with the absorption requirement; however, absorption tests may also be made on 0.1-m cores in lieu of breaking the pipe. The frequency of tests to destruction will depend on the consistency of the manufacturer’s pipe to pass the D-Load. As stated in the Standard Specifications, test sections of pipe which are not required for use in the absorption test and which satisfy the requirements of the specified load tests will not be further load-tested and such sections may be marked "Tested" and accepted for use. If need be, the manufacturer should patch the cracks neatly with grout for the sake of appearance.

Specifications now allow smaller pipe to be non-reinforced. Such pipe when tested will fail spontaneously. The inspector should not place his head or person within such non-reinforced pipe as serious injury could result if the pipe fails prematurely.

Some of the other tests performed at the manufacturer's plant include the following:

Test	Remarks
• Permeability or Hydrostatic Joint Joint Test (Rubber Gasket Joint)	Witness by Inspector
• Infiltration Test (porous pipe)	Witness by Inspector
• Compressive Strength Tests	Witness by Inspector

2.8.2.5(5) Re-tests

If a specimen fails and re-tests are allowed, at least two additional specimens will be required for the re-tests. All retest samples must comply with test requirements for the pipe to be acceptable. Only one retest is to be allowed.

2.8.2.5(6) Unusually Large Pipe

If pipe is too large for the testing machine, acceptability may be determined by tests of the quality of the concrete as placed in the pipe and by examination of the quality, amount and placement of the reinforcement, when specifically approved by Headquarters. The strength of the concrete shall be determined by testing cylinders made from the concrete under identical conditions with the pipe, or by test of cores drilled from the pipe, depending on instructions from the Office of Structural Materials. Compressive strength must meet the specified minimum in the pipe tables for the class tested.

2.8.2.6 Final Inspection

Inspect all finished pipe carefully for general workmanship, dimensions, marking, and finish. Look for breaks or fractures, exposed steel, large or deep cracks, surface roughness, etc. Wind checks or fine shrinkage cracks are often found in the larger diameter pipes. If such cracks are tight and shallow, the pipes are generally acceptable. Refer also to specifications for specific defects that constitute cause for rejection. Measure wall thickness, internal diameter, and length of pieces of pipe in the lot inspected to the extent necessary to provide reasonable assurance of compliance with specifications. The Inspector's assigned Lot Number (prefixed with the word "Lot") shall be durably and plainly marked on the surface of accepted pieces of pipe. The manufacturer's trademark, size, class of pipe, and date of manufacture must also be marked on each joint. Be sure that, in the case of pipe with an elliptical cage, the pipe is properly and correctly marked with waterproof paint stripes to indicate top and bottom positions for laying.

2.8.2.7 Reporting

Record and report total length of each size and pipe class (include "D-Load"), and the length of the individual sections, and compressive strength, when required. Report pipe details and test data on a suitable test report form. Most pipe manufacturers provide a standard test report form, which will generally be acceptable. Copies of the test report are to be maintained in the contract files of the Office of Structural Materials and the local Quality Assurance and Source Inspection Branch. Copies of the test report form need not be sent to the Resident Engineer.

Pipe test reports should include the following information:

State Lot Number and Name & Signature of Inspector.
Internal diameter, wall thickness, and length of section.

Total length of pipe represented by test(s) (meters).
Type of reinforcing cage (circular or elliptical).
Area of steel per linear foot.
Date(s) of manufacture.
D-Load* at which first hair crack occurred.
Actual D-load per foot at which minimum crack occurred.
Required D-Load or "load to produce required crack" (AASHTO).
Actual breaking D-load per meter (if tested to destruction).

Note : *Generally the total machine loads are determined from the jack calibration curve and the required total loads recorded during tests. D-Loads are calculated from these total loads.

Sources of aggregates and cement (brand and type).
Method of curing (Steam or Water).

2.8.3 Non-Reinforced Concrete Pipe (Irrigation and Non-Pressure Drainage)

2.8.3.1 General

Non-reinforced concrete pipe may be substituted for reinforced concrete pipe 900 mm in diameter or smaller, providing it meets the requirements listed in Section 65-1.02A(1) of the Standard Specifications. Larger sizes may be specified for specific contracts. The reference specification for this pipe will generally be AASHTO M 86 or ASTM C 14.

Non-reinforced concrete pipe is used mainly for irrigation or non-pressure drainage purposes. Check all contract specification requirements carefully prior to inspection. Be sure that fabricator is completely familiar with material, fabrication, and test requirements.

2.8.3.2 Sampling and Testing Materials

For sampling and testing of concrete and aggregates, refer to "Reinforced Concrete Culvert Pipe," 2.8.2. No steel reinforcement samples are required.

2.8.3.3 Inspection of Fabrication

Observe mixing and fabrication of pipe as necessary to see that homogeneity, proper consolidation, and satisfactory finish are obtained per specifications. Placement and size steel reinforcement are not required. Make every effort to obtain the cooperation of the fabricator in securing compliance with specifications.

2.8.3.4 Testing of Pipe

2.8.3.4(1) Samples

Select random samples of pipe proposed for use, for tests as specified. Normally crushing strength (3-edge or sand-bearing), hydrostatic, and absorption tests are required by the specifications. Usually at least two specimens are selected for each size of pipe in the order. The inspector may select additional specimens up to 0.5% of the total number of each size pipe involved in the order. See "Sampling", 2.8.2.5(2), for general criteria used in deciding on the total number of specimens. The same general criteria apply here. Specimens shall be sound pipe which conform to all requirements of the specifications, insofar as can be determined prior to testing. The Inspector designates how many specimens shall be subjected to crushing tests and how many to hydrostatic tests. Normally the specifications require that 75% of the specimens selected shall be tested for strength. Absorption test specimens are taken from pipe broken in the crushing test.

2.8.3.4(2) Test Equipment

The manufacturer shall furnish testing equipment and manpower for the specified tests. Check general characteristics of testing machine and associated equipment for compliance with the applicable specifications. See "Testing Machine and "Equipment," 2.8.2.5(3), regarding acceptance of calibration certificate. Note specification requirements for rate of application of load. Familiarize yourself with the calibration chart so you will know the loads corresponding to the gage readings (if machine does not indicate load directly). Compute total stress corresponding to required stress per lineal foot.

2.8.3.4(3) Test Procedure (D-Load)

Witness crushing tests on specimens selected for that purpose. Tests shall be performed in accordance with the applicable specifications. See that pipe is dry and otherwise in condition for testing per specifications. Check manner in which specimen is placed under load, position relative to bearing edges, etc. When so specified, test may be performed by either the 3-edge or sand-bearing method. See that rate of loading is as specified. Test sufficient pieces to destruction to obtain adequate absorption test data, which may be witnessed in the plant or performed at the Office of Structural Materials. In the case of a failure in the crushing test, the manufacturer may submit for retest two additional specimens for each one that failed. All retest specimens must comply with specifications for the pipe to be acceptable. Pipe not damaged in testing may be included in the order.

Witness hydrostatic test on specimens selected for that purpose (normally not over 25% of total number of specimens selected for test). Test specimens and procedure must comply with specification requirements. The required hydrostatic pressure ("head") must be observed. Specifications normally require that there shall be no leakage. See specifications for specific requirements concerning "culling" of stock in case of failures, etc.

Record all test data for inclusion in shipping report.

2.8.3.4(4) Inspection of Pipe

Check finished pipe for compliance with dimensional and workmanship requirements. Check internal diameter and wall thickness. Make sure pipe is straight and concentric, within specified limits, and free from defects. Refer to applicable specifications for detailed workmanship requirements and rejectable defects. See that type and design are as specified.

The Inspector's Lot Number shall be durably and plainly marked on the inside surface of all accepted pieces of pipe; the number should be prefixed with the word, "Lot". Check for compliance with other marking requirements specified.

2.8.3.5 Reporting

Record and report quantities in length for each size of pipe. The following test data shall be listed on the test report, usually supplied by the manufacturer:

State Lot Number and Inspector's name & signature.

Total quantity (Lin. Measurement) represented by test(s).

Date of manufacture.

Dimensions (internal diameter and wall thickness).

Lengths of sections.

Specified ultimate load.

Actual ultimate test load (or highest load applied).

Results of hydrostatic tests.

Sources of aggregates and cement (brand and type).

2.8.4 Reinforced Concrete Sewer Pipe

The general inspection procedure is similar to that described under "Reinforced Concrete Culvert Pipe," 2.8.2, except for certain variations due to differences in specifications. Normally AASHTO M 170 applies in the case of reinforced concrete sewer pipe. The principal variations between the specifications for reinforced concrete culvert pipe and reinforced concrete sewer pipe concern the number of samples to be tested, design, markings, and strength test limits. Quite often the use of Type V cement is required because of its greater sulfate resistance and the concrete coverage of the steel reinforcement may be greater. Check specifications carefully, and except for variations due to the above-mentioned specification differences, proceed in the same general manner as described for reinforced concrete culvert pipe.

2.8.5 Non-Reinforced Concrete Sewer Pipe

Except for differences in specification requirements concerning retest procedure, culling of pipe, hydrostatic test, etc., the general procedure is the same as described for "Non-Reinforced Concrete Pipe (Irrigation and Non-Pressure Drainage)," 2.8.3. Check specifications very carefully and, with such modifications as are necessitated by the differences in specifications, proceed as described in 2.8.3.

2.8.6 Precast Manhole Sections, Rings, and Tapers

General requirements are listed in Section 70-1.02H Precast Concrete Structures of the Standard Specifications. This in turn refers to AASHTO Designation M 199. Refer to special provisions for special requirements as these materials are often governed by local agency code. The manufacturing process is very similar to that of reinforced concrete pipe.

2.8.6.1 Inspection

Normally, under AASHTO specifications, acceptance is based on material tests (see 2.8.2), certified test reports, and the inspection of the finished product. Check for compliance with applicable specifications. Concrete is normally governed by compressive strength. Acceptance of the sections will be based on visual inspection and the manufacturer's certified test reports. Occasional concrete test cylinders should be taken for tests by the Office of Structural Materials.

2.8.6.2 Reporting

Report the size and number of units. File all certified test reports for concrete and steel reinforcement and manhole steps in the local Quality Assurance and Source Inspection Branch file.

2.8.7 Concrete Pipe Underdrains

Procedure shall be as described for "Non-Reinforced Concrete Pipe (Irrigation and Non-Pressure Drains)," 2.8.3.

2.8.8 Porous Concrete Pipe

This type of pipe is produced by using a coarse aggregate concrete mix in which the cement mortar is kept to a minimum. Spaces between the aggregate are partially filled with mortar creating a porous cross section through which water can easily penetrate. Inspection and testing procedures are in general similar to those described for "Non-Reinforced Concrete Pipe (Irrigation and Non-Pressure Drainage)," 2.8.3, except that a "rate of infiltration" test is required instead of the hydrostatic test. Witness this test, which shall be performed as required by the specifications. Record the rate of infiltration in your inspection report.

2.8.9 Precast Prestressed Concrete Piles

Refer to Standard Specifications Section 49-3 Precast Prestressed Concrete Piles and Section 50 for prestressing requirements and the contract special provisions, and plans for any exceptions. Except for special designs the details of standard precast prestressed concrete piles are found in Standard Plans Sheets B2-5, B2-6, and B2-8. “C” (corrosion resistant) piles require extra care in producing, as well as inspection. Shop drawings are normally not required but any deviation from plans must be approved by the Resident Engineer. Shop drawings are customarily used for production.

NOTE : Refer To Part 3, Precast Prestressed Concrete Products For Inspection Procedures For Prestressing Operations And Other Applicable Requirements.

2.8.9.1 Sampling and Testing of Materials

Check cement, admixtures, aggregates, and reinforcing steel for compliance with material specifications as described in 2.8.1.2, General Procedures for Precast Concrete Products.

The sampling, testing, and inspection of prestressing strand is covered in Part 3, Precast Prestressed Concrete Products.

2.8.9.2 Inspection of Fabrication

Section 90 of the Standard Specifications lists the concrete requirements. Observe mixing and fabrication procedure as necessary to verify compliance with specifications. The concrete mix design of an established precast concrete manufacturer does not require the approval of the Resident Engineer. For “C” piles, the concrete must have a minimum of 8 sacks (450 kg) of cement per cubic yard. The concrete materials (cement, aggregates and admixtures) must comply with the Standard Specifications.

Steel forms are normally used to cast the piles. These forms are made to fixed cross section dimensions of standard size piles so dimensional checking is unnecessary after you have checked it once for yourself. Lengths of piles are adjusted by sliding steel end forms. It is important that forms are cleaned after each pour and a bond breaker applied to metal surfaces to ensure sound and undamaged surfaces during pile removal.

Check spiral reinforcement for size, spacing, and clearances – usually 1” from form. Ensure that the spiral has the 135-degree hook at the spiral lap areas and at their ends (Re: Sec. 52-1.07 Placing). teel lifting loops must be placed to be 1” clear of prestressing strand and the lifting loops must be recessed 1” and covered with epoxy for “C” piles (Re: Sec. 49-3.01). Check longitudinal reinforcement for size, spacing length and cleanliness.

Refer to Part 3, Precast Prestressed Concrete Products for the inspection procedures for the prestressing operation.

During concrete placement verify the consistency of the concrete by the Kelly Ball penetration test. Penetration tests must be conducted before the addition of plasticizer admixtures to obtain accurate and consistent readings. Take the necessary number of 6” x 12” concrete test cylinders for determining the required transfer strength and 28-day compressive strengths or witness fabricator taking cylinders properly. Test cylinders for transfer strength must be cured in a manner representative of how the concrete piles are cured. To determine compressive strength, 28-day test cylinders will normally be tested by the manufacturer. Test cylinders will be kept in a temperature controlled water bath until tested.

Curing of concrete will usually be by steam curing. Monitor steam temperatures and the holding period and temperature gradient to ensure compliance with Section 90-7.04 Curing of Precast Concrete Members. Be sure that steam enclosures, usually tarpaulins, are securely held down and not susceptible to removal by wind. Temperature recorders with time/temperature graphs are required to monitor steam cycle. These graphs should be examined to verify compliance with steam curing requirements. Corrosion resistant (“C”) piles are required to be kept wet for a total of 7 days, including the steam curing cycle.

2.8.9.3 Final Inspection and Reporting

Inspect finished piles for straightness, finish, freedom from defects (see specifications). Piles which are used for columns above grade must meet the Class 1 surface finish requirements for the length of pile above grade. In lieu of inspection tags, the Inspector's State Lot No. should be marked on each pile released for shipment. The Inspector must verify that all piles have been marked with the Lot # prior to allowing shipment of the piles. The manufacturer should also mark the contract number, casting date and length of each pile on each pile. Specifications do not allow precast concrete piles to be driven until 14 days after casting. No piles should be released until curing requirements have been fulfilled and the 28-day compressive strength requirement has been met. Piles for shipment should be lifted and supported at designated locations which will not cause injury to the piles due to excessive dead load deflections.

2.8.9.4 Reporting

On the Report of Inspection TL-0029 record the Inspection Lot Number, the total length released, size of pile, type of pile, and the number of piles and their lengths.

2.8.10 Precast Concrete Lighting Standards

The inspection procedure is similar to that of precast prestressed concrete piles. This type of lighting standard is usually a proprietary design and is manufactured to a local agency (city or county) specification as a replacement-in-kind for standards that must be relocated due to a realignment of a state highway. Specifications will generally be less stringent than Caltrans requirements. Concrete and reinforcement must conform to the special provision and plan requirements. Material test reports and a Certificate of Compliance must be provided by the manufacturer. Accept on visual inspection. The number and type of standards inspected are to be reported on the Report of Inspection

2.8.11 Concrete Masonry Blocks

Refer to contract special provisions and contract plans for specification requirements to determine extent of sampling, testing, and inspection. The common reference specification is ASTM C 90. Concrete masonry units are most commonly used in buildings (maintenance stations, roadside rests, etc.) and sound walls. For sound walls higher strength blocks may be specified. Color of blocks, as well as the surface texture, are often specified and a sample of the blocks to be furnished must be submitted for the Resident Engineer's approval. Dependent on the end use of the blocks, inspection procedures will vary.

2.8.11.1 Sampling Testing and Inspection

Blocks will generally be furnished by established manufacturers who maintain quality control testing records, using either their own testing Laboratory facilities or those of private testing laboratories. The sampling and testing of individual units is generally covered under ASTM C 140, which requires sampling for strength, absorption, and volume change. For Grade N-II units, normally specified on our projects, compressive strength tests and absorption are required.

For compressive strength testing only, three units should be selected from each lot of 10,000 units or fraction thereof and six units from each lot of more than 10,000 and less than 100,000 units. Masonry units released must also conform to the specified unit weight for concrete. Periodically, submit representative samples of blocks to Materials Engineering and Testing

Services in Sacramento or local District Materials Laboratory for quality assurance tests, irrespective of the manufacturer's in-house quality control testing.

Specifications for masonry units used in the construction of sound walls may require prism testing either for control or research tests. Prism test specimens are to be fabricated in accordance with UBC Sec. 2404. For individual masonry units delivered to the job site for erection, the Resident Engineer will normally be responsible for seeing that the prism test requirements are fulfilled. For prefabricated masonry unit walls, such as the "Tomax" Wall Panel, the Office of Structural Materials Inspector at the source of manufacture will be responsible for seeing that prism tests are conducted. The prism test consists of an assemblage of two units which are mortared together and either grouted or ungrouted dependent upon wall construction method. The prism is subjected to a compressive strength at 28 days. Prism testing is generally a responsibility of the contractor.

The color and surface texture treatment of units inspected should be as specified, or as in many cases as approved by the Engineer. As masonry units are a machine-molded product, there will seldom be dimensional problems. The inspector should check that the units being shipped are fairly consistent in color and texture and are not cracked or chipped or otherwise damaged due to poor handling or storage.

2.8.11.2 Prefabricated Masonry Unit Walls ("Tomax")

The prefabricated masonry unit walls should be inspected during the course of fabrication to insure that a good mortar joint is being achieved; mortar joint alignment is satisfactory; the specified reinforcement is being installed; the color and texture of individual units are fairly uniform; and the storage and handling of the wall panels is such that chipping, cracking, and disruption of fresh mortar joints is not occurring. It is not intended that continuous inspection be necessary on these prefabricated wall panels as fabrication is performed with fully automatic equipment. The frequency of random inspections should be sufficient to insure that the quality of workmanship and materials is consistent and meets specification requirements. This is a proprietary manufacturing process and is not frequently furnished to Caltrans projects.

2.8.11.3 Reporting

Masonry units, whether individual units or made into prefabricated wall panels, are to be tagged when judged acceptable and reported as to number. The grade or strength of masonry building units should be listed on the TL-0029. Be sure to note if blocks being furnished are High-strength blocks and note their compressive strength

2.8.12 Precast Reinforced Concrete Soundwalls

The inspection procedure is essentially the same as for other precast reinforced concrete products except that fabrication inspection need not be so intensive as that for bridge members, such as girders and piles. Soundwalls are generally not prestressed. The Inspector must monitor the placement of mild steel reinforcement and the anchor plates. Section 90-10 Minor Concrete of the Standard Specifications will generally govern the concrete used. Nonetheless, sampling and testing of cement, aggregates, and admixtures should still be conducted. Certificates of compliance or mill test reports for reinforcing steel should be obtained prior to casting. All embedded anchor plates must be inspected to ensure that welding and galvanizing of bearing plates conform to specifications. Curing compound is generally used to cure the concrete. This should be checked to see that it is the specified type. Precast sound walls are generally painted. The paint should be sampled to insure that it complies with specifications and is the designated color. Concrete is currently designated by cement content; however, it is good practice to take occasional concrete test cylinders for informational purposes. Kelly Ball penetration tests should be taken to provide a record of fresh concrete consistency.

2.8.12.1 Fabrication Inspection

During fabrication, the Inspector should ensure that formwork dimensions are correct and sufficiently rigid to hold their position during concrete placement. Form surfaces should be such as to provide the specified surface texture, usually a simulated slumpstone. These form surfaces will usually be fiberglass or a hard rubber. A light coating of form oil is acceptable; however, excessive form oil may impregnate the concrete surface and destroy bond of subsequent paint coat.

Reinforcement should be checked to see that it is the correct size, accurately placed, and has sufficient clearance. At the same time, check all embedded hardware, especially end bearing plates to see they are positioned accurately and properly secured to avoid displacement during concrete placement. Sufficient vibration should be used to consolidate concrete. After concrete placement the concrete should be struck off to a level, flat surface, and the required surface finish applied uniformly from panel to panel.

Most precast sound wall panels are specified to have a slumpstone texture on one side and a broomed finish on the opposite side. The slumpstone finish is usually produced by the form surface and the broom finish by hand. These finishes should be as uniform as possible from panel to panel. After the final finish is applied, the panels should be covered or curing compound applied as soon as possible to prevent drying shrinkage cracks. Upon removal from the forms curing compound should be applied to all the formed surfaces.

After the cure period, the fabricator will paint the panel surfaces unless they are to be job-site painted. See that the specified number of coats, usually two, of the specified type and color of paint are applied. Paint color and texture of wall surfaces must be approved by the Engineer. A sample reference panel is usually cast at the start of the job.

2.8.12.2 Reporting

Upon final inspection, the Inspector will tag acceptable panels. The number of panels released with the width and heights of individual panels will be reported on the Report of Inspection TL-0029.

2.9 FENCING

2.9.1 General

2.9.1.1 Scope

This section is devoted primarily to inspection procedures for chain link fence, freeway fence and new property fence (wire, posts, gates, and accessories) with a brief mention of special types such as slatted chain link fence and wooden fences. Most of these types of fences are specified in Section 80 Fences of the Standard Specifications. Wire fence products are normally referenced to ASTM and AASHTO Specifications:

- Chain Link Fabric: AASHTO M 181, Type I, Class C Coating
- Barbed Wire: ASTM A 121; either 12-1/2 ga. Class 1, 13 ½ ga. Class 3, or 15-1/2 ga. Class 3 Type Z (See Sec. 80-3.01C for additional req.)
- Wire Mesh: ASTM A 116, Grade 60, Type Z Class 1 (See Sec. 80-3.01D for additional requirements
- Posts & Braces: Commercial quality; however, must meet the requirements of Sec. 80-4.01A for coatings and min. resisting moments.

Wood posts and fencing materials are specified in Section 80-3.01B and the contract special provisions. Wood posts may be treated and untreated.

2.9.1.2 General Information

For wire fences, such as chain link, barbed wire, and wire mesh fence, the procedure involves checking fabric or barbed wire (and tension wire) for gage, condition and weight of galvanizing, appearance, and finish, checking posts and braces for dimensions, weight per foot, and inspecting gates and hardware for design, fabrication, and galvanizing as required by the contract specifications.

For material for special timber fences, checking timber for grade and dimensions (and treatment, if specified) is usually sufficient.

All ferrous materials must be galvanized or have a corrosion protective coating as required by the specifications.

2.9.2 Chain Link Fence

Refer to Standard Specifications Section 80-4 Chain Link and special provisions. Requirements for chain link fabric will normally be referenced to AASHTO M 181, Type I with Class C Coating (1.2 oz./sq. ft.). In lieu of Type I (galvanizing), chain link fabric may be specified as Type II (Aluminum coated steel) and Type III (PVC coated steel) for smoothness and aesthetics reasons. Be sure vendor is aware of the specific contract requirements.

2.9.2.1 Sampling and Testing

Samples of the chain link fence materials, including fabric, posts, braces, and hardware should be taken and evaluated by our Laboratory for compliance. Sample posts for testing in accordance with California Test Method 674. Domestic certification must be provided when required. Small parts such as hinges and latches may be exempt.

Representative samples of chain link fence materials should be forwarded to the Structural Materials Testing Branch for all required tests. Unless otherwise specifically required by the specifications, sample at least one roll for each lot of 50 rolls or fraction thereof offered for inspection. No less than two rolls should be sampled. Samples shall be one meter wide for the full height of fabric. The inspector should make a preliminary check of the gage and visible imperfections of wire and galvanizing. Verify that the selvage type at top and bottom of fabric is as specified. For hot-dip galvanized fabric check for frozen joints at wire intersections. If fabric does not pass visual inspection, there is no reason to submit samples for tests. The Inspector may witness tests by the manufacturer in lieu of sending samples to the Structural Materials Testing Branch.

Rejection because of loose or lumpy galvanizing on galvanize wire will require good Inspector's judgment. Galvanizing chain link fabric is a process in which it is difficult to obtain consistent and uniform coatings. Experience and knowledge of what can reasonably be expected of a well-controlled operation should be the basis of acceptance or rejection. Slight roughness, such as one or two small, tightly adherent "beads" or lumps per diamond may be acceptable. "Frozen" knuckles, loss of zinc or poor adherence, excessive or large globules of zinc, rust, or other defects listed in the specifications will be cause for rejection. If you wish a judgment from the laboratory on workmanship of samples in addition to the usual test for weight of coating, be sure to state this on the sample ticket and mark the various samples so you can identify them with the corresponding portions of the lot being inspected.

Also check posts, tension wire, and accessories for compliance with specification. See that tension wire is galvanized per specifications and falls into the category of commercial quality spring steel. Watch for any tendency of coating to flake off when wire is manipulated. See that tie wires are galvanized per specifications and of gage specified. Vinyl coated chain link fabric shall be sampled and tested in accordance with reference specifications. Post and accessories shall have matching coatings when vinyl coated fabric is used.

Chain link fabric may be slatted with plastic or wooden slats. Slats, both plastic and wood, must be evaluated for specification compliance. Fabric may be woven from pre-galvanized wire. Mesh size is usually larger to accommodate placing of slats. Check mesh openings for dimensional requirements and ensure that slats are securely anchored, usually by heavy galvanized staples.

Check posts for compliance with specifications. Also check dimensions per specifications. Take samples of pipe posts for galvanizing tests; a magnetic gage may be used on posts with flat surfaces (such as H-posts). Check enough posts to represent the stock adequately. The extent of overall sampling and testing required for posts will depend on the specifications. As in the case of the fabric, this requires judgment and experience. In sampling posts for bend tests, proceed in accordance with specifications (usually 1 from each lost of 1500 or fraction for testing by California Test Method 674).

NOTE: Use of the magnetic gage for checking pipe posts in small lots is permissible, but the stripping test is the official method for pipe and should be used for any sizable lot or in case of any questionable readings regardless of lot size. For posts coated by the chromate conversion system the testing must be performed by the Office of Testing and Technology Services, Chemical Testing Branch.

Check accessories and fittings for workmanship, dimensions, condition of galvanizing, etc. If doubtful about weight of galvanizing, take random specimens for tests.

2.9.2.2 Inspection

If preliminary inspection and all tests are satisfactory, make final visual inspection of fabric, posts, and other parts for workmanship, dimensions, condition of galvanizing, and freedom from defects, in accordance with specifications. Check galvanizing for excessive roughness, blisters, sal-ammoniac spots, bruises, and flaking. Care and judgment must be exercised in making this final inspection. Check weave and selvage (knuckled or barbed) of fabric for compliance with specifications. Each roll of fabric must be tagged, showing the length, kind of base metal, kind of coating, specified wire size, height of fabric, and the name of the manufacturer.

If gates are included in the order, review the plans for design and dimensions. Welding of gate and fence components must be in accordance with the best commercial practice. Check welded connections to see that they have been cleaned and regalvanized or painted with an approved zinc paint. During fabrication check materials used, any galvanizing, and observing fabrication as necessary.

2.9.2.3 Reporting

Report quantities of accepted items in appropriate units on Form TL-0029. List number of rolls and type of fabric (CL-4, 5,6, etc); primary mesh size, type of slating when furnished; size, type, and lengths of posts; number and sizes of gates; etc. An itemized packing list of the supplier may be used to aid in identifying the quantities and materials shipped.

2.9.3 Barbed Wire (type BW) and Wire Mesh Fence (type WM)

For requirements, refer to the Standard Specifications (Section 80-3.01C for Barbed Wire, and Section 80-3.01D for Wire Mesh) and special provisions. Detailed requirements for various approved types of coated barbed wire (either 12-1/2 ga. Class 1, (13-1/2 gage Class 3) or 15-1/2 gage Class 3 Type Z) are in ASTM A 121. Detailed requirements for the coated wire mesh normally required (Grade 60, Type Z Class 1) are in ASTM A 116. Be sure that the fabricator understands all requirements and is clear on the interpretation of the specifications.

2.9.3.1 Sampling and Testing

Tests may be witnessed if practicable; but occasional check samples should also be taken. If the section modulus of the metal post section has not been determined, compute it or send a sample or dimensioned sketch to the Office of Structural Materials for evaluation. Weight per foot can be checked in the shop or on a sample post in the laboratory.

Sample barbed wire and wire mesh as required by the applicable specifications. Take a sample 1-meter long from the end of a spool or roll for each lot of 50 spools or fraction thereof. The maximum number of samples required for each shipment is seven. Normally the gage will be checked in the laboratory as well as the weight of galvanizing and any required tensile. Use caution when witnessing the sampling of barbed wire spools as they are tightly wound and could cause injury to the sampler.

2.9.3.2 Inspection of Barbed Wire and Wire Mesh

After completion of galvanizing tests and gage measurements, inspect visually for galvanizing and general workmanship. Check number of strands and gage and spacing of barbs, etc., on barbed wire. On wire mesh, check condition and uniformity of galvanizing, general workmanship, dimensions, and spacing of wires and stays, per specifications. Be sure each roll is tagged and all information required in the specifications is marked on the tag.

2.9.3.3 Gates

Verify that materials, fabrication, and galvanizing conform to specification requirements. All hinges must be as specified. Generally, all materials should be approved prior to fabrication. However, fabricated gates from a reliable manufacturer may be accepted on visual inspection and magnetic thickness gage checks of the galvanized components. (If other than commercial quality steel is specified, mill tests and a certification will also be required.) Check design, dimensions, and workmanship for compliance with specifications. Check appearance and uniformity of galvanizing. Also check gate and fencing accessories. Be sure that any welding of gates at corners and braces are of good commercial quality.

2.9.3.4 Reporting (Type BW & WM Fence)

Record and Report:

1. Total quantity (linear measurement), number of spools or rolls. List gage and spacing of wires for wire mesh.

2. Number, lengths, type and sizes of posts shipped.

3. Number, types, and sizes of gates shipped.

4. Number of braces shipped.

5. Accessories (gate and attaching hardware) shipped.

2.9.4 Posts and Braces

2.9.4.1 Inspection of Posts and Braces

See that metal posts are sampled and checked for weight, section modulus, etc. Inspect visually for fabrication and workmanship and for conformance to specified dimensional tolerances. Check wooden posts for dimensions and freedom from excessive structural defects, such as large, loose, or numerous knots, shakes, splits, etc., per specifications. For untreated posts, season checking is not necessarily detrimental unless it extends through the post (in which case it is graded as a split) or extends into the center and goes the full length of the post. Bear in mind that some checks, knots, etc., can be tolerated as long as you are satisfied the post will be structurally adequate for expected conditions of handling, installation, and use, and have the full required dimensions. See 2.5.3 "Treated Timber and Piles" for inspection of treated posts. Treated posts (sawn) usually are required to conform to specific grades. Check round posts for conformance to peeling requirements. Check posts for marking as specified.

2.9.5 Special Fences

Check special provisions. Inspect for compliance with specific requirements. Inspection of timber for special wood fences will in general be in accordance with procedures described for "Timber" (2.5).

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2.10 GUARD RAIL, MEDIAN BARRIERS, AND BRIDGE BARRIER RAIL

2.10.1 General

2.10.1.1 Scope

This section primarily addresses the source inspection procedures for fabricated metal guard railings and bridge barrier railings, steel hand railing, cable median barrier, and guard rail anchor materials.

2.10.1.2 General Information

Inspection of guard and bridge railings normally includes sampling and testing of materials and inspection during and after fabrication for compliance with specifications and approved drawings where applicable. Design details of these items may be generally found in the Standard Plans, except for special designs. Materials and workmanship requirements for most applications can be found in Section 83 Railings and Barriers of the Standard Specifications. The inspection should include dimensional checking to the specified design details. Tests of completed posts and/or rail elements will also be required in some instances. Welding materials and workmanship are normally specified in the AWS D1.1 Structural Welding Code.

2.10.2 Metal Beam Guard Rail and Beam Type Barrier

See above for general requirements for these materials. Requirements for metal beam guard rail elements, terminal end and return sections, and mounting hardware will be generally referred to AASHTO M 180, Class A, Type 1 Coating, except as modified in Section 83-1.02B. Verify that the fabricator clearly understands all the contract requirements. In the case of a new fabricator, go over the entire inspection procedure with him in detail and discuss material and fabrication requirements thoroughly before fabrication begins.

2.10.2.1 Sampling and Testing

Get a Certificate of Compliance and mill test reports for metal beam rail elements and component parts and hardware. Take periodic check samples for tests by the Office of Structural Materials. Obtain certified mill test reports for all steel items such as anchor plates, rods, etc. that are required to conform to ASTM or other specifications. Also take random check samples from each stock lot of plates, shapes, and bars. Sample bolts and nuts per ASTM specifications. Refer to 2.4.7 for sampling and inspection of cable end anchors and fitting. When bar reinforcing steel is used, obtain a Certificate of Compliance or mill test report. Cable clips should be certified as drop forged. Have at least one forged or welded end anchor rod with eye hole tensile tested out of each 200 or fraction thereof. Domestic certification must be provided when specified.

2.10.2.2 Fabrication Inspection

Inspect metal beam rail elements, including mounting brackets, end terminals and returns, and mounting hardware for compliance with specifications. Obtain certified test reports to verify material compliance. Check rail elements for: required manufacturer's markings, gage, dimensions, rolled edges, freedom from damage and surface defects. Each rail element shall be identified with the name of the manufacturer, ID to verify heat number, Coating Lot, AASHTO specification number, and Class and Type. Inspect railing during and after fabrication and see that cutting, punching of holes, etc., are done neatly. Damaged galvanizing must be repaired by painting with two coats of approved zinc primer. See that bolt holes are free from burrs and rough edges and check diameter and location for conformance with plans. Check marking of rail elements against the furnished test reports. Verify that all supplied components, other than the rail elements, also meet the materials and workmanship requirements.

2.10.2.3 Galvanizing and Painting

For galvanized rail, spot check thickness of zinc and overall quality of coating. Use a magnetic thickness gage to check galvanizing thickness. Type I coating requires 2.0 oz./sq. ft.

Note that this is the total coating of both sides. Inspect galvanized surface visually for freedom from such defects as excessive roughness, blisters, and damage from fabrication. Repair damaged galvanizing with two coats of approved zinc-rich primer.

For special coatings or uncoated ("weathering" steel) rail, follow specifications and current instructions. Be sure to check chemistry of "weathering" steel and also conformance to handling and cleaning requirements. For "weathering" steel, be sure that bolts, nuts, channel, etc., are of a similar corrosion-resistant steel. Also that rail and channel have been uniformly pickled or blasted.

2.10.2.4 Posts and Blocks

Check posts (and blocks, in the case of barriers) for compliance with specifications. Be sure that dimensions are as specified. For steel posts, verify steel specification and galvanizing. Check bolts, nuts, washers, etc., for specification, dimensions and galvanizing per specifications and drawings. For timber posts and blocks, see 2.5.3, "Treated Timber and Piles," and 2.10.4, "Inspection of Posts and Braces."

2.10.2.5 Anchorage Materials

Get samples for testing as described in 2.11.3.1, "Sampling and Testing." Make a visual inspection of all hardware and cable anchors for compliance with specifications. When welded eye anchor bars are furnished, the formed eye must be closed with a complete penetration weld. Cable end anchor assemblies must comply with specification requirements listed in Section 83-1.02B. The cable anchor assemblies will generally be inspected and shipped from the cable manufacturer.

2.10.2.6 Reporting

Report on Report of Inspection TL-0029 the total linear measurement (feet, meters) of railing released. Include the number and lengths of rail element released, quantities of end terminals, type of post and spacers (steel or wood), and mounting hardware, etc. Forward a copy of all certified mill test reports to the local Quality Assurance and Source Inspection Branch file along with a copy of the Form TL-0029.

2.10.3 Fabricated Tubular Hand and Bridge Railing

These railings generally consist of fabricated tubular sections that are grouted directly into the concrete barrier or mounted using anchor bolts. The commonly used hand railings are detailed in the Standard Plans. Special railing details will be found in the contract plans and special provisions. Refer to Standard Specifications Section 83-1.02 for typical materials and workmanship requirements. Welding is normally governed by the AWS D1.1 Structural Welding Code.

2.10.3.1 Sampling and Testing

Obtain certified mill test reports for tubular sections and all other primary steel components. See that high-strength bolts and anchor rods are sampled for tests. Sample at least one anchor bolt assembly (bolt, nut, and washer) of each size and heat presented. Before sampling, check thread fit to see that they are not excessively overtapped, refer to Section 75-1.05. Domestic certification must be provided for all ferrous metal parts when specified.

2.10.3.2 Inspection

Verify acceptability of steel components by reviewing certified mill test reports and confirming check sample tests. See that welders are qualified per AWS D1.1 specifications and that all welding conforms to visual inspection requirements. Check completed railing for overall workmanship and dimensions, including spacing of any bolt holes. Check fit of any slip joint sleeves. Ensure that all welded joints in tubular rail elements are complete penetration. This will require a backing sleeve at each weld joint. Check for flush grinding of welds as specified. Check workmanship and galvanized coating thickness, using a magnetic film thickness gage. See that posts and other members are within tolerances for squareness, straightness, etc. Base plates may often be excessively distorted due to welding. These may be mechanically straightened after galvanizing. Require that all burrs and fins be removed from holes and ragged edges ground prior to galvanizing. Anchor bolt assemblies must be fabricated to the details shown on the plans. Do not permit any welding on the grip area of high-strength anchor bolts and rods (A449). Customarily, bridge and barrier rails will be hot-dip galvanized. Inspect galvanizing in accordance with 2.4.8 Galvanizing. Should painting be required, refer to the special provisions and ensure that manufacturer provides the specified paint and cleans and paints the surface in accordance with the specified contract requirements.

2.10.3.3 Reporting

Record on Report of Inspection TL-0029 the total linear length of rail released (indicate Standard Plan Type). List the individual lengths of rail, the number of posts and type, anchor bolt assemblies, and if mounting hardware is released with the shipment.

2.10.4 Fabricated Steel Barrier Railing

Most bridge barrier railing is now reinforced concrete; however, there may be occasions where special fabricated steel barrier rails are specified. Inspection procedures will essentially follow those for 2.11.3 Fabricated Tubular Hand and Bridge Railing. Refer to contract plans and special provisions for special type designs.

2.10.4.1 Sampling and Testing

Check materials used for compliance with specifications. For pipe hand rail, check type, weight, and size of pipe. When specific chemical and physical requirements for rail or other parts are included in the specifications, take samples for testing or secure certified test reports as necessary to assure compliance with specifications. Domestic certification must be provided when specified.

2.10.4.2 Inspection

Refer to 2.11.3 Fabricated Tubular Hand and Bridge Railing.

2.10.4.3 Reporting

Refer to 2.11.3 Fabricated Tubular Hand and Bridge Railing.

2.10.5 Chain Link Railing (Bridges) (See also 2.10.2)

Details for this type of railing are normally found in the Standard Plans. Materials and workmanship are listed in Section 83-1.02I of the Standard Specifications. Exceptions will be noted in the contract plans and special provisions. Get mill test reports and random check samples for tubing, shapes, and bars. Although galvanize coating may be used, either aluminum coated steel or PVC coated chain link fabric are frequently used for this type of railing, as the smoothness of this finish will not cause skin abrasion to passing pedestrians. Get a one-foot by full height sample of fabric furnished. Obtain a sample of the high tensile tension cable as well. Verify the quality of all fencing hardware by visual inspection. Mounting hardware requires either galvanized coating or coating similar to the fabric coating, both as to type and color.

2.10.5.1 Inspection

Make visual inspection of fabricated items for workmanship and dimensions. See that vinyl-coated mesh has a complete and uniform coating. Check fittings and hardware for dimensions and conformance to material requirements (get test reports or certifications). Domestic certification must be provided when specified.

2.10.5.2 Reporting

Report the various items in appropriate units on Form TL-29.

2.10.6 Cable-Chain Link Median Barrier

Check special provisions and plans. Sample cable and pulls per special provisions. Check turnbuckles, hardware, etc. for compliance with specifications.

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2.11 SIGNALS, LIGHTING AND ELECTRICAL EQUIPMENT

2.11.1 General

Source inspection of most electrical equipment outlined in Section 86 of the Standard Specifications is the responsibility of the Office of Testing and Technology Services. Do not undertake the source inspection of this or any non-standard electrical equipment, unless specific requests have been received from the Office of Testing and Technology Services.

The Office of Structural Materials is specifically responsible for items found in Section 86-2.04 Standards, Steel Pedestals and Posts of the Standard Specifications. Special attention should also be given to Section 86-2.15 Galvanizing and Section 86-2.03 Foundations, for the anchor bolts.

2.11.2 Administration

As with any item OSM inspects, the DC-CEM-3101 (previously referred to as the HC-30) Notice of Materials to be Used begins the inspection process. Any DC-CEM-3101 that contains items specific for the Office of Testing and Technology Services shall be annotated with an EE and forwarded to:

Electrical Testing Branch
5900 Folsom Blvd, RM 402
Sacramento, CA 95819
Fax # (916) 227-7026

Materials that fall under OSM responsibility (signal/lighting poles, fasteners and anchor bolts) will be responded to via a TL-608. Each branch office should track signal/ lighting pole information by contract on the tracking sheet provided in (Appendix D-8).

2.11.3 Inspection and Sampling

2.11.3.1 General Electrical Commodities

Any witnessing of the manufacturer's testing, requiring electrical expertise, should only be performed by the Office of Testing and Technology Services.

2.11.3.2 Anchor Bolts and Fasteners

Anchor bolts shall be of the type specified in Section 86-2.03 Foundations of the Standard Specifications. Fasteners utilized in assembly of the poles and standards shall conform to Section 86-2.04. High-strength fasteners and anchor bolts are subject to specific source inspection requirements. Refer to Section 2.4.9 Structural Fasteners, Bolt for General Applications, and Anchor Bolts/Threaded Rods, of this manual for further clarification.

Anchor bolts and other fastener components and assemblies may be shipped by the Fabricator's QCM to the Office of Structural Materials, in advance of main pole shipments to the job site, for QA testing and evaluation. In this case, a form letter will be sent from the OSM Testing Lab to the Fabricator after evaluation of the fasteners has been completed.

2.11.3.3 Standards, Steel Pedestals and Posts

In general, standards, steel pedestals and posts will be inspected to the Welding and Steel Inspection Checklist (Appendix J). As a minimum, it is recommended that the following inspection frequency be performed during source inspection.

- Sections I through IV, check each item once per source inspection visit, in which fabrication is occurring.
- Sections V, Items 28-34, check one pole per contract..

Dimensions are generally verified in pages 263-338 of the Standard Plans, July 1999. However, inspectors must review the specifications for the particular contract and be alert to any deviations from the Standard Specifications and Plans. Specifications in effect at the time of contract advertisement govern for the life of that contract. Materials and workmanship shall conform to the requirements listed in Section 86-2.04 of the Standard Specifications and the applicable Standard Plans, unless superseded by the contract special provisions and plans. Special attention should be given to language of any 8-3 requirements in the Special Provisions.

Most signal and lighting support structures are currently fabricated out-of-state. Quality assurance inspections will be conducted on periodic visits to the manufacturing plant to check the fabrication and welding quality of the product. Release will be contingent on receipt of the Manufacturer's Certificate of Compliance, certified mill test reports for component materials, proper QC being performed by the fabricator and close visual inspection of the final product before incorporation into the project. The following inspection guidelines should be followed.

- An inspector should be sent to each fabricator on a regular schedule (typically on a two-three week cycle for two working days). Before arrival, the current Signal and Lighting Pole Tracking Sheet (Appendix D-8) should be reviewed for any contract specific outstanding issues.
- During inspection, the Welding and Steel Inspection checklist (Appendix J) shall be used to verify fabricators QC, as stated previously.

Please see Section 1.1.6 Example Situations of this chapter for a detailed example of the Signal and Lighting Pole inspection process.

2.11.4 Reporting

All signal and lighting standards that conform to the contract documents will be Orange Tagged from the Fabricator to the job site by the Office of Structural Materials. Each TL-29 shall include one copy of the Welding and Steel Inspection checklist (Appendix J). Signal and lighting standards that do not comply with the contract documents will not be Orange Tagged. OSM inspectors should not undertake field inspection of signal and lighting poles unless under the direction of the Branch Senior.

2.11.5 Non Conformance Issues

With large numbers of signal and lighting poles being manufactured for Caltrans projects procedural errors by the fabricator will not be considered cause for a NCR. The fabricator will be notified of the problem and have the opportunity to fix it on the next visit. This issue should not affect the release of poles already manufactured. If however, these mistakes are repeated an NCR can be issued, (NCR's for these items will be approved by the Branch Senior). NCR's associated with general workmanship and quality should follow the normal procedures outlined in Section 1.8.5.2 of this manual.

2.11.6 Example Situations

The following examples are given as an aid in understanding the "ideal" source inspection process for signal and lighting poles. As situations vary greatly between fabricators, adjustments will be necessary. Contact your Lead Inspector and/or Branch Senior for guidance in unusually situations that may be setting a precedent.

2.11.6.1 Inspection Request Received

Inspection requests should be sent to OSM on a regular cycle by the vendor at least 1 week before the requested date, to ensure travel itineraries are made. Ideally source inspection will coincide with California poles being in all stages of fabrication. The fabricator may submit an inspection request with the following information to aid our inspector's preparation before the visit.

- List of all California projects currently being fabricated.
- The estimated status of fabrication for each project on requested inspection date.

Once assigned, it becomes the inspector's responsibility to research the contract documents and the Signal and Lighting Pole tracking sheet to address any potential issues before the out of state inspection occurs.

2.11.6.2 Source Inspection

During source inspection, it is important to remember that as Quality Assurance OSM is verifying the Quality Control process of the fabricator. Treat each visit separately and verify the fabrication process in accordance with the Caltrans requirements wherever possible by using the Welding and Steel Inspection checklist (Appendix J). For example, the following projects and their status are as follows during an inspection.

- 12-054204 11 poles Fabrication
- 02-231044 3 poles Fabrication
- 04-288124 16 poles Pre-galv
- 07-1064U4 7 poles Pre-galv
- 05-122564 21 poles Complete
- 10-076524 10 poles Complete

Sections I-III of the checklist are verified in general with any Caltrans projects and only needs to be checked for one contract per visit.

Section IV of the checklist is completed by randomly checking each line item once in the fabrication stage per visit. In this case, any of the 14 poles from Dist 12 and Dist 2 projects could be looked at. It may not be possible to check due to the various stages of fabricating, however, every effort should be made to check each item at least once.

Section IV Items 28-34 of the checklist should be verified at a higher frequency of each line item per contract. Thus, each line item for the 16 Dist 4 poles will be checked once as will each line item on the Dist 7 poles.

2.11.6.3 Non Conformance Reports

Due to the unique scheduling for source inspection of signal and lighting poles, NCR's will require some special considerations. In general situations with the finished product missing documentation or visually demonstrating inferior workmanship an NCR could be issued. For example, undersized welds are found on all Dist 4 and 7 poles ready for galvanization. As this problem cannot be corrected in one shift, an NCR is issued. When all welds are repaired at a later date the NCR is considered resolved.

NCR's related to the fabricator's procedure should be carefully considered. Any NCR that addresses procedure will receive final approval from a branch senior. This is necessary because of the potential problems that may arise when addressing any of the fabricator's current procedures. When NCR's of this nature are issued, it will not affect poles ready for release, because of likely delays in projects.

2.11.7 Additional Information for High-Mast Lighting and CCTV Standards

High-mast lighting and CCTV standards require special consideration during the source inspection process. The design of high-mast lighting standards is usually custom and of a proprietary nature. Minimum details are furnished in Standard Plans ES-6J. Manufacturers must submit working drawings, showing that the material and fabrication details conform to special provisions and contract design requirements. A large opening is required near the bottom of the vertical pole for installation of the cable motor and winch that raises and lowers the luminarie ring. Most of these designs incorporate a heavy, welded reinforcing ring to strengthen the pole section removed by this opening. The complete penetration welds used to join the reinforcing ring to the tubular section must be closely inspected for joint fit-up and weld quality.

High-mast poles often incorporate a number of slip joints in the segmented pole shaft to achieve the specified height. The slip joints are dependent on a snug friction fit to maintain their integrity and avoid movement. The fabrication and fit-up of the slip joints shall be carefully examined. The longitudinal welds on both sides of the slip joint are required to be complete penetration for a distance of 150 mm beyond the overlapped joint section. Because high-mast lighting standards are larger and much taller than typical lighting supports structures, they are subjected to greater wind loads. It is important that thorough quality assurance inspections be performed during fabrication, especially on these tall support structures.

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2.12 OVERHEAD SIGN STRUCTURES

2.12.1 Administration

2.12.1.1 Action for New Projects

New projects that contain CMS or Sign Structures in the bid items will require a memo being generated for the Branch Seniors signature. This memo (Appendix D-2) will be sent to the RE/SR and stress the following:

- The bid items requiring special attention, CMS and all Sign Structures.
- The SMR for the project.
- The requirement of a DC-CEM-3101.
- The requirement of a pre-welding meeting.
- The requirement of an approved WQCP.
- The requirement of an approved set of Shop Drawings.

2.12.1.2 Action upon Receipt of CEM 3101

After the CEM-3101 is received, a letter will be sent out to the fabricator (Appendix D-4). The fabricator's letter will be sent out with the TL-608, stressing the QASI process for sign structures and will be signed by the Branch Senior.

2.12.1.3 Pre-Welding Meeting

During the pre-welding meeting, the SMR shall review the QASI procedures required before OSM can release sign structures at the source. During this meeting, the importance of receiving a copy of approved Shop Drawings and an approved WQCP shall be stressed. Without these approved documents OSM will not release any material at the source.

2.12.1.4 Sign Structure Tracking Spreadsheet

Each SMR shall compile the information listed in Appendix D-8 for all projects with sign structures for which they have responsibility. SMRs will ensure the District 8 SMR is provided with the current information for each of their projects at least every other week. The District 8 SMR will compile this information and provide the Office Chief an updated spreadsheet no later than the 10th of each month.

2.12.1.5 Action Upon Receipt of Inspection Request

After an inspection request is received by the responsible Branch, dispatching personnel will notify the responsible SMR of the inspection request. If OSM has not conducted a pre-weld meeting or received the approved shop plans and WQCP, the SMR will notify the RE and SR. The memorandum (Appendix D-6), signed by the Branch Senior, will inform them of the deficiencies preventing OSM from being able to perform the inspection and release the material at the source.

2.12.1.6 Responsibilities

Prior to dispatching an inspector to a fabrication shop, Lead Inspectors are responsible for ensuring the assigned inspector receives the most current compilation of Sign Structure data from the District 8 SMR. The inspector will verify and review the required approved documentation prior to departing for the inspection. In all instances of Source Inspection on sign structures, the District 8 SMR is available to answer questions concerning sign structure documentation (CEM-3101, approved WQCP and approved Shop Drawings). If the RE/SR, Contractor or Fabricator has not provided these items, the inspector will notify the SMR. In cases where the inspector learns of the project while at the fabrication site or instances where the proper procedure were not followed, the inspector will complete the inspection and generate a TL-6034 for the RE/SR to review. Inspectors will not release material unless the following conditions apply:

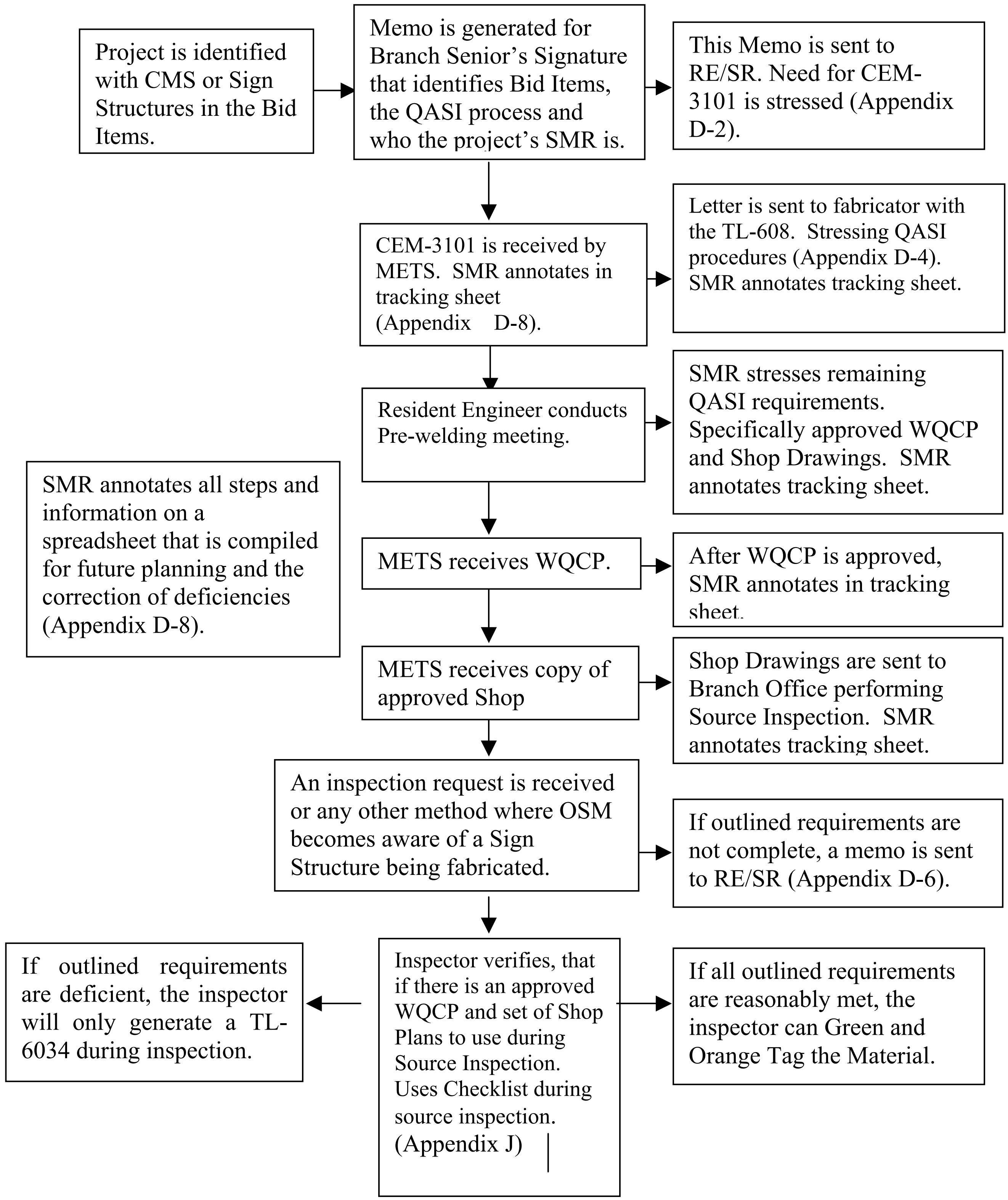
2.12.1.7 Documentation

During Source Inspection the inspector will fill out all applicable information and attach the current Welding and Steel Inspection Checklist (Appendix J) to the TL-29 or TL-6034. During Source Inspection, the assigned inspector will perform the following steps:

- Check with appropriate Lead or SMR and confirm that WQCP and Shop Plans are approved. If not, then no green or orange tagging will occur and project material will be documented by the use of a TL-6034.
- Supplemental information on the sign structure will be documented by the use of a Welding and Steel Inspection Checklist (Appendix J). This form will be filled out and attached to the TL-6012 or TL-6034 before the structure is galvanized.
- After the sign structure is galvanized, the inspector will return to the fabricator and perform final inspection, TL-6034 and/or release, TL-29.

After Source Inspection is performed and reports are distributed, the SMR will provide the District 8 SMR with updated information with respect to how much of each bid item has been released.

Figure 2-1. Flowchart of inspection procedures for sign structures



2.12.2 Specific Inspection Requirements

2.12.2.1 Scope

For steel sign structures, the materials and workmanship requirements are specified in Section 56 of the Standard Specifications. Standard designs are detailed in the Standard Plans. The contract plans must be reviewed for exceptions. Overhead sign structures have become increasingly larger and more complex in recent years. The greater use of welded and high-strength bolted connections and non-redundant tubular sections requires the same demanding level of source inspection and testing that is required for structural steel bridges. Fabricators of steel sign structures must be able to provide the same high quality of workmanship as required in steel bridge structures as well as maintaining the same level of in-house quality control. Special provisions for fabricated steel sign structures may require the same weld quality control requirements listed for welded steel bridges, and if structural fasteners are involved, the same requirements for storing, handling, inspecting, testing, and installing high-strength fasteners that are specified for structural bolted joints in bridges.

The AWS D1.1 Structural Welding Code will generally govern the welding of sign structures. For more complex sign structures AWS D1.1 may be superseded by the AWS D1.5 Bridge Welding Code.

2.12.2.2 Inspection of Fasteners

General requirements for fasteners used in sign structures: All requirements as outlined in Section 2.4.9 of this Source Inspection Manual shall be followed for steel sign structures when tensioning fasteners in bolted connections of subassemblies or when assembling and erecting the entire sign structure at the job site. For steel sign structures, if the fabricator puts subassemblies together using structural bolts, he shall be responsible for performing high-strength bolting operations following requirements in the RCSC Specification, including preliminary testing (pre-installation and RoCap), installation procedures, and final tension verification (torque checks) on 10% of the bolts in each completed joint. When tensioning fasteners at his facility, the fabricator shall:

1) Have a copy of and understand requirements stated in the RCSC Specification.
2) Correctly store and handle fasteners, maintaining lot integrity and identification for all fastener components,
3) Possess, maintain, and use suitable tools for high-strength bolting, including a calibrated bolt load meter and torque wrench,
4) Perform pre-installation and RoCap tests on each lot of high-strength fasteners and DTIs when required,
5) Have a copy of the Structural Bolting Handbook on hand, and be familiar with testing requirements for short and long bolts and DTIs,

6) Have a copy of the manufacturer's installation instructions available for TC bolts and DTIs, if being used and installed,
7) Furnish a full set of test reports for each lot of fastener components, as listed in the applicable ASTM(s)
8) Perform verification testing of 10% of the fasteners (minimum of 2) in each joint

If the inspector is responsible for fastener installation either at a fabrication shop or at the job site, he shall verify that all preliminary testing is being done and done properly, fastener installation is correctly done, and shall inspect finished bolted joints after fastener installation has been completed.

Sampling of fasteners: Samples of each lot of fasteners shall be taken by either the QCM or Inspector, (if present). Samples and required test reports shall be sent to the Structural Materials Testing Branch for QA testing and evaluation, according to the process detailed in Section 2.4.9.

Fastener packaging and shipping requirements: When loose fasteners are provided by the sign fabricator for use in the sign structure, and are shipped to the job site with the unassembled sign structure components, either a) the original lubrication provided on fastener by the fastener manufacturer shall be insoluble in water, or b) all fastener components shall be packaged and shipped to the job site in waterproof containers. If the lubricant is alleged to be waterproof, the fabricator will provide a) a certificate of compliance from the fastener manufacturer responsible for providing the original lubricant on the fastener components, and b) the brand/ model of lubricant used.

2.12.2.3 Sampling and Testing

Steel materials used in fabrication may be accepted on certified mill test reports, supplemented by check sampling of about 10% of the heats. ASTM specifications will generally govern the steel requirements. Charpy impact requirements are not normally specified. Tubular sections must be inspected at the source of fabrication to ensure that bending is performed in an acceptable manner. Verify that any supplied anchor bolts and rods and high-strength fasteners including DTIs for connections are sampled and tested and conform to requirements in the appropriate ASTM or AASHTO specification. For box beam closed truss sign structures the ribbed sheet metal shall be checked for conformance to ASTM A 653/A 653M, Designation SS, Grade 33 and zinc-coated (galvanized) by the hot-dip process to a G165 Coating Designation (References to ASTM Specifications A 446, Grade A and A 525 are now obsolete). Carbon steel sheets used to fabricate signs shall conform to ASTM A 1011/A 1011M, Designation SS, Grade 33 (References to ASTM Specifications A 569 and A 570, Grade 33 are now obsolete). Domestic certification for steel shall be furnished when specified.

When zinc prime coating and finish coating is required, these paint products must be sampled and tested prior to use. Source inspection will include inspection of blast cleaning and painting to the requirements of Section 59 Painting.

2.12.2.4 Fabrication Inspection

USE THE OFFICE OF STRUCTURAL MATERIALS WELDING AND STEEL INSPECTION CHECKLIST FOR SIGN STRUCTURES AS A GUIDE FOR FABRICATION INSPECTION. THE CHECKLIST SHALL BE COMPLETED BY THE INSPECTOR ON PLANT INSPECTION VISITS FOR ALL CHECKLIST ITEMS OBSERVED (SEE APPENDIX J). WELDING OF SIGN STRUCTURES IS REQUIRED TO CONFORM TO THE REQUIREMENTS OF AWS D1.1 STRUCTURAL WELDING CODE, EXCEPT AS MAY BE MODIFIED IN A CONTRACT. THE GENERAL INSPECTION GUIDELINES LISTED IN PART 3 WELDED STEEL STRUCTURES MAY APPLY TO MANY OF THE FABRICATION OPERATIONS FOR LARGER SIGN STRUCTURES.

Check workmanship and thickness of zinc on galvanized members. The finished product should conform to all requirements of contract specifications and plans. Working drawings are required to be submitted for approval.

2.12.2.5 Reporting

List the number and type of sign structures released on the Report of Inspection TL-0029. A brief description of the sign structure type, overall span length, and column and post heights should be provided for each inspected structure as well. Provide also the type of coatings used.

2.13 SIGNS, MARKERS, AND TRAFFIC SAFETY DEVICES

2.13.1 General Information

Some of the items covered in this section are State-furnished to the Contractor. Both the delivery and acceptability of State-furnished materials are the responsibility of the Resident Engineer. Most of the State-purchased materials are no longer source inspected by the Office of Structural Materials. Inspection guidelines provided in this section will consist only of general directions for those items that would normally be source inspected. More detailed instructions will be issued as needed for unusual products.

2.13.1.1 Scope

Included in this category are the following items :

- Highway Signs (State-furnished*)
- Guide and Culvert Markers – Sec. 82 Markers & Delineators
- Reflectors and Target Plates " " "
- Pavement Markers - Sec. 85 Pavement Markers
- Traffic Stripes and Pavement Markings – Sec. 84

* State-furnished materials are furnished from State warehouse stock, obtained by State Purchase Orders

Many of these items are of low structural criticality and may be accepted from established manufacturers on certificates of compliance and certified test reports, providing they meet visual inspection requirements. The Office of Structural Materials retains the prerogative of occasionally check sampling and testing to verify compliance.

2.13.2 Highway Signs

Signs are made of a wide variety of materials and in various designs and dimensions. They are usually obtained by purchase order, and the specifications and inspection requirements vary widely. The State purchasing division may request source inspection. Inspection guidelines will need to be adjusted on a job for job basis, based on purchase order requirements. Inspections should not be performed without specific authorization of the local Quality Assurance and Source Inspection Branch. The Inspector will rely on instructions from the inspection supervisor when performing sign inspections.

When inspection is assigned by Form TL-0028 for a given purchase order, a copy of the purchase order and copies of specifications and drawings will be forwarded with the Form TL-0028, or as soon as available. Check all specifications and drawings carefully, and make sure vendor understands fully what is required.

2.13.2.1 Sampling and Testing

See that base materials (metal, plastic, etc.) are as specified. Obtain all necessary mill test certificates and certificates of compliance. When test requirements are included in the specifications, forward check samples of base material to the Office of Structural Materials for testing. See that galvanized base metal is properly etched or otherwise prepared for painting when so specified. All aluminum sheets should be checked for required pretreatment of surfaces. Sample reflective sheeting for tests as specified. For baked enamel and porcelain enamel signs, check enamels for compliance with specifications. Sample when necessary. Also check application, film thickness, smoothness, adherence and general appearance of paint coating per specifications. See that enamel adheres tightly and is not easily peeled off. Send sample panels for furnished signs to the Office of Structural Materials for special tests when so directed. Support posts for highway signs may be timber poles, finished lumber posts, and steel posts. As these are usually State-furnished to the Contractors, these are purchased by the Department and furnished from Maintenance Warehouses. Source inspection of posts will follow the requirements listed in the purchase orders.

2.13.2.2 Inspection

Check finished signs for compliance with design and dimensional requirements, freedom from defects, correctness of lettering, and general conformance to drawings and specifications. Inspect for color by matching to a color chip. All metal framework must be inspected to see that fabrication complies with specifications. Special attention must be given to welded and riveted joints. The inspection of signs requires great care and thoroughness. Special instructions should be requested from the supervisor of the local Quality Assurance and Source Inspection Branch whenever there is any doubt as to requirements or acceptability. Advise the supervisor of the local Quality Assurance and Source Inspection Branch in writing of any special difficulties or problems encountered. See that packaging and handling of signs for shipment comply with specifications.

2.13.2.3 Reporting

Report quantity of each type of sign inspected on Report of Inspection Form TL-0029. Provide a brief description (type of metal, coatings, etc.) of the signs released. Copies of TL-0029 must be sent to the receiving State warehouse.

2.13.3 Markers and Delineators and Snow Poles

2.13.3.1 Scope

Ground mounted markers and delineators are described and specified in Section 82 of the Standard Specifications. Details of the various markers and snow poles can be found in the Standard Plans. In addition to being supplied as contract items these are purchased for maintenance replacement and as State-furnished materials. Purchase orders by the

Department's warehouses may specify special requirements. The Inspector must first review the requirements for the materials to be inspected. Target plates and marker panels may be manufactured from zinc plated steel sheet (ASTM A 525) or aluminum sheet (Alloy 300-H14, painted in accordance with the specifications. Either galvanized steel posts or flexible plastic post may be specified. Snow poles are specified as galvanized steel posts. Target plates and marker panels in addition to being painted may require special color markings, lettering, reflectorized sheeting, and installed reflectors.

2.13.3.2 Inspection

These materials may be accepted on certificates of compliance and certified test reports of established manufacturers. The Office of Structural Materials retains the prerogative to check sample and test materials to verify compliance as directed by the Engineer. Verify that all the base materials for marker plates and posts conform to the base metal and coating specifications. Obtain mill test reports for all metals and certificates of compliance from the manufacturer. Samples of the base materials and samples of painted panels for testing by METS may be taken when there is reason to doubt the validity of the furnished certifications. Check hot-dip galvanizing of posts for the required zinc coating weight.

Spot check dimensions of finished products for compliance with plan details. Fabrication must be accomplished in a uniform and workmanlike manner. Ensure that all sheared and cut edges are clean and straight and all holes are free from burrs and jagged edges.

Check the installation of reflectorized sheeting, lettering, and reflectors to ensure they are securely attached and that all stenciled markings have the proper legend and letter size. Reflectorized sheeting must be applied in accordance with the specification requirements to ensure proper bonding.

2.13.3.3 Reflectors

Requirements for standard reflex reflectors are listed in Section 82-1.02F of the Standard Specifications. These are purchased in large quantities and shipped to specific projects or locations from warehouse stock, either loose or attached to marker plates. The supplier's stock may be sampled and tested for color, reflectance, and water-tightness. Acceptance may be made on the basis of certificates of compliance and certified test reports. with shipments usually made from tested and approved stock. When reflectors are shipped separately, report quantity, size, type and color on Report of Inspection TL-0029.

2.13.3.4 Wood Posts

If wood posts are used to mount markers, check grade and treatment (if specified) as described for "TIMBER", 2.5. Wood posts are specified to conform to the provisions of Section 56-2.02B Wood Posts and Braces.

2.13.3.5 Metal and Flexible Posts

Refer to Section 82-1.02 for posts requirements. Details and dimensions are found in Standard Plans Sheet A73. For metal posts verify that they are the proper thickness and obtain copies of certified mill test reports to verify conformance to ASTM A 525. Flexible (plastic) posts are specified in the special provisions. Obtain certified test reports to verify conformance to the specifications and submit check samples as required for check testing to the Structural Materials Testing Branch. Acceptance will normally be on the basis of acceptable certifications and the posts meeting all visual inspection requirements.

Observe fabrication of post manufacturing to ensure that workmanship is accomplished in a uniform and workmanlike manner. Watch particularly cutting and forming, punching of holes, and dimensions. Check galvanizing coating thickness using a magnetic type gage.

Check finished posts for dimensions, size and location of holes, slots, etc., workmanship, galvanizing, and general compliance with specifications and drawings. Check edges and holes for freedom from burrs and uneven cuts. All mounting hardware (bolts, nuts, and washers) shall be the required size. Commercial quality hardware is acceptable.

2.13.3.6 Reporting

Ground mounted marker and delineator are usually shipped as complete assemblies or components shipped separately. List quantities and description of materials released on Report of Inspection TL-0029. Descriptions should be that provided in the Standard or contract plans.

2.13.4 Culvert Markers

Culvert markers fall into the same category as the ground mounted markers described in the previous section 2.13.3 and the same inspection guidelines apply. Requirements are listed in Section 82 of the Standard Specifications with details shown in both the Standard Plans and contract plans.

2.13.5 Traffic Line Paint, Glass Beads, and Thermoplastic Pavement Markings

2.13.5.1 Scope

Requirements for these materials are listed in Section 84 Traffic Stripes and Pavement Markings of the Standard Specifications or State purchase orders. Generally, these products are acceptable on certificates of compliance and certified test reports from established manufacturers. These materials are frequently purchased in large quantities by our Office of Business Management on purchase orders. Paint from manufacturers who have not previously passed State testing shall be sampled. (Refer to "PAINT", 2.17, for sampling and inspection of paint.) Most thermoplastic striping and glass beads are furnished from out-of-state manufacturers. For thermoplastic striping and glass beads, certified representative samples will be sent directly to Materials Engineering and Testing Services for testing. Accepted materials will be identified by the manufacturer's batch or lot numbers. When source inspection is performed, refer to either the contract or purchase order specifications for inspection and any sampling requirements.

2.13.5.2 Reporting

Report quantities, description of materials, container size, State specification number, batch or lot numbers, and dates of manufacture on Report of Inspection TL-0029.

2.13.6 Pavement Markers-Permanent and Temporary Types only

2.13.6.1 General

Pavement markers are described and specified in Section 85 of the Standard Specifications. The Department maintains a list of Pre-qualified and Tested Signing Delineation Materials outlined in the 1999 Standard Special Provisions, Section 08-01, Materials.

a) OSM will respond to Notice of Materials to be Used (DC-3101) on specific pavement markers supplied by the pre-qualified vendor with a Notice of Materials to be Inspected (TL-28) asking the supplier to ship the material to the job site along with the COC and all other required QC documentations. RE may still sample markers at the job site.
b) Pavement markers supplied by other than the pre-qualified suppliers will not be accepted. The SMR will advise new suppliers to submit a New Product Information Form to the New Product Coordinator at the Translab. New supplier may be added to the list of Pre-qualified and Testing Signing Delineation Materials after the product has been reviewed, tested, and accepted by the Department.
c) OSM will randomly sample pavement markers sampled at the source according to the standard specifications and special provisions.

2.13.6.2 Sampling, Testing and Reporting

a) Pavement markers will be randomly sampled at the source according to the standard specifications and special provisions.
b) Samples will be forwarded to the appropriate Lab for testing along with the TL-101.
c) Test results will be forwarded to the supplier, RE and the source inspection branch for records.
d) Re-sampling of failing test samples may be taken at the discretion of the Engineer and according to the standards.

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2.14 METAL CULVERTS AND RETAINING WALL

2.14.1 General

2.14.1.1 Scope

This section covers the following materials, which generally will be governed by the Standard Specifications and Standard Plan details and reference AASHTO specifications:

- Corrugated Metal Pipe (CMP) Re: Sec. 66 / AASHTO M 36
- Corrugated Aluminum Steel Pipe Re: Sec. 66 / AASHTO M 196
- Structural Plate Pipe & Arches Re: Sec. 67 / AASHTO M 167
- Perforated Metal Pipe (PMP) Re: Sec. 68 / AASHTO M 36, 196
- Bin-Type Retaining Wall Re: Special Provisions & Plans
- Bituminous Pipe Coating & Lining Re: Sec. 66 /AASHTO M 190

2.14.1.2 General

Inspection of these items will in general consist of the following procedures:

1. **Obtaining a Certificate of Compliance for each shipment from the fabricator**: This will certify compliance with all contract requirements, list quantity, give a description of the material (including gage and heat numbers), type of coating, and state that mill test reports are available for our review. These reports should be periodically reviewed to verify material compliance. Domestic certification must also be provided when specified.

2. **Checking zinc coating thickness with a magnetic gage in accordance with California Test Method 652 to verify compliance with AASHTO M 218**: Galvanize coating weight, as well as physical test requirements, will be verified by periodic check samples of each gage and steel manufacturer used in fabrication. For established fabricators, check samples should be taken at least every 6 months, or more often when it is suspected that there are materials problems.

3. **Taking periodic test coupons for lock-seam joints used for helically corrugated pipe, spot weld test samples, and continuous welded helical seams**: Sample shall be submitted for each steel gage used in fabrication. Helical lock-seam joints must comply with the requirements of California Test Method 662. Spot welds and welded helical seams shall conform to AASHTO M 36. If the fabricator has in-house testing facilities, testing may be witnessed by the Inspector.

4. **Checking gage or weights of material and finish dimensions of pipe for conformance to allowable tolerances**: Refer to applicable AASHTO specifications. Individual steel sheets are identified by the manufacturer.

5. **Checking the fabrication workmanship**: Verify that riveting, resistance spot welding, or helical lock seaming complies with specification requirements. End finish of pipes shall be performed so the pipe sections can be effectively joined with standard coupling bands.

6. **Verifying that the band couplings used to join pipe sections meet the specified designs of Section 61, AASHTO M 36, and the Standard Plans details**.

7. Ensuring that bolt assemblies are properly marked and corroborative certified mill test reports are furnished (if the plant supplies bolt assemblies for structural plate pipe): Take check samples of bolt assemblies if not properly certified. Three sample assemblies of each diameter bolt are sufficient.

8. **Reviewing the fabricator's materials files periodically for certified test data**: Verify the compliance of materials fabricated before the releasure of any materials.

2.14.2 Corrugated Metal Pipe (CMP)

Check the contract requirements. Note particularly any special requirements, such as bituminous coating or paving, any fabricated pipe fittings, etc. Inspection guidelines listed in 2-1301.2 will generally provide an adequate level of source inspection.

2.14.2.1 Sampling and Testing

Except as previously noted for check sampling, sampling and testing of each heat of steel will normally not be required. Obtain a Certificate of Compliance for each shipment of materials released to contract and verify that certified test reports are maintained in the fabricator's file. Spot check galvanized coating weight by means of a magnetic gage. The number, size, and frequency of check samples should be in accordance with current instructions.

2.14.2.2 Inspection

Inspect fabricated pipe thoroughly for compliance with dimensional and workmanship requirements. Verify that thickness (gage) is as specified. Check spacing, tightness, edge distance, or general condition of riveted and spot welded joints. Make inspections of lockseam joints per specifications and verify that check samples have complied with specifications. Check any formed end finish of pipes for cracks or other defects. For perforated pipe check pattern, spacing, and neatness of perforations.

Heat numbers on the pipe must match those listed in the fabricator's certification. Select several of the listed heats and request mill tests for these heats from the fabricator. Zinc coated sheets must comply with AASHTO M218 and aluminum coated steel sheets with AASHTO M274. Check the mill test results for compliance. These reports should cover mechanical property tests, chemical analysis, and coating tests.

2.14.2.3 Bituminous Coated, Lined, and Paved CMP

2.14.2.3(1) Sampling and Testing (Coatings)

A Certificate of Compliance from the coating supplier that material complies with AASHTO M190 must be furnished. Check samples of the bituminous coating shall be taken periodically to verify compliance with AASHTO M190. Sample the coating by scraping a sample from the inside top of a coated pipe. Use the furnished sample tins to obtain a sample weighing at least 0.30 kg. Ensure that the periodic check samples of coatings passed tests.

For pipe requiring only bituminous coating an asphalt mastic coating complying with AASHTO M 243 or a polymeric coating complying with AASHTO M 246 may be substituted for the AASHTO M 190 bituminous coating. Obtain certificates of compliance for these materials and send check samples to Materials Engineering and Testing Services for tests. A quart sample of the asphalt mastic will be sufficient. The polymeric coating is applied to the steel sheet at the manufacturing plant. Therefore, a sample of the polymeric coated sheet must be submitted.

2.14.2.3(2) Inspection

Carefully review Section 66-1.03 of the Standard Specifications to ensure that the fabricator has used the proper material and procedures. Make thickness checks of coating, lining, and invert paving with appropriate gages to verify compliance with the minimum specified thickness.

As bituminous coating will cover manufacturer’s markings on the sheets, the thickness (gage) shall be clearly marked on the surface of the bituminous coating to facilitate pipe gage determination at the job site.

For bituminous lined pipe verify that rivets are placed in the valley of the corrugations. Bituminous lining must be applied by the centrifugal process.

2.14.2.4 Arched CMP

The same requirements for circular CMP apply to arched CMP. Inspect arched pipe after forming. Sections damaged during the arching process may be repaired (if repairable) or rejected. Check corner radius and other specified dimensions. Inside or outside radius gages are supplied for checking corner radius. Do not check radius at the ends only! Check at several points along the length. Any "crimping" at the corners will be cause for rejection.

2.14.2.4(1) Reporting

Report shipments on Form TL-0029. Show quantities of each size in linear measurement (feet, meters), list the minor and major axis dimensions, and gage. Note any bituminous coatings on this report.

2.14.3 Structural Metal Plate Pipe

Review Section 67 Structural Metal Plate Pipe for general requirements. Steel plate pipe is referred to AASHTO M 167 and aluminum plate pipe to AASHTO M 219. Check the contract special provisions and plans for specific details.

2.14.3.1 Sampling and Testing

Sample and test in accordance with applicable portions of 2.14.2, Corrugated Metal Pipe, and periodically check to see that mill test reports are available as required. For structural plate pipe and arches the gage of steel will vary around the pipe circumference. Obtain a Certificate of Compliance and certified test reports identifiable to the plates supplied.

High-strength bolts and nuts used to splice the seam joints of the corrugated plates are radiused on their contact surfaces to conform to the plate corrugations. For steel plate culverts, fasteners shall conform to requirements in AASHTO M 167M (metric units) or M 167 (inch-pound units). Anchorage bolts and nuts are low strength, and shall conform to ASTM A307 and A563 Grade A respectively. Seam bolts and nuts are high strength, and must conform to ASTM A449 and A563, Grade C respectively. See AASHTO Specifications for additional fastener requirements and for requirements for metric fasteners, if provided. Fasteners are normally supplied by the structural plate pipe manufacturer, have a short grip length, and require special jigs for testing. Seam bolts and nuts are acceptable on the manufacturer's certified test reports and are normally not sampled.

2.14.3.2 Inspection

The individual plates must be identified with the AASHTO designation, name of fabricator, plate thickness, zinc coating weight, heat number, and coating lot number. Check these against the certified test reports.

Check condition of galvanizing, forming, general appearance and workmanship, and dimensions.

2.14.3.3 Reporting

Report on Report of Inspection TL-0029 the linear feet of pipe, diameter or minor and major axis of pipe, specification, and connecting bolts supplied.

2.14.4 Metal Pipe Siphons, Downdrains, etc.

2.14.4.1 General

Inspection guidelines for these type of pipes are essentially the same as for corrugated metal pipe.

2.14.4.2 Inspection

Refer to Standard Specification Section 66-3.07 “Siphons,” and Section 69 “Overside Drains” and contract special provisions and plans for special requirements. Check materials and workmanship for conformance to specifications and any special requirements. Ensure that pipe seams on siphons are close riveted and soldered pipe in order to secure an airtight joint.

2.14.4.3 Reporting

List the linear amount or number of pipe sections, size or general description of parts on Report of Inspection Form TL-0029.

2.14.5 Bin Type Retaining Walls

Requirements are listed in contract special provisions and plans. The wall sections are generally formed galvanized steel sheets or plates that are assembled in place by bolting. The materials and designs of these types of walls vary considerably. Check special provisions and plans before inspection.

2.14.5.1 Inspection

The inspection guidelines of 2.14.2, Corrugated Metal Pipe, for check sampling and fabrication inspection will provide an acceptable level of source inspection. Inspect visually for dimensions, freedom from defects, condition of galvanizing and general compliance with workmanship and design requirements, per special provisions. Check gages of sheets and that forming of sheets are performed in a workmanlike manner which does not result in cracking of the bent metal and damage to galvanizing if the sheets are pre-galvanized. See that bolts are furnished to the proper specification and galvanized when specified.

2.14.5.2 Reporting

These walls are normally paid as a lump sum quantity. Report quantities, description and sizes of individual wall sections, gage of material, and surface coatings on Report of Inspection Form TL-0029.

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2.15 METAL PIPE (OTHER THAN CULVERT PIPE)

2.15.1 General

2.15.1.1 Scope

This section covers cast iron pipe for special drainage or water line installations, cast iron soil pipe, galvanized steel pipe for water services, welded steel pipe, and special metal pipe. Requirements for these types of pipe will generally be listed in Section 70 Miscellaneous Facilities with references to various ASTM and American Water Works Association (AWWA) specifications. The contract special provisions and plans must be reviewed for special designs and exceptions. Often, the reference specifications will be those of a local utility district.

2.15.1.2 General

The specifications for these items, especially for cast iron pipe and large diameter welded steel pipe, vary from job to job, and include special requirements that necessitate special care in inspection. Therefore, all applicable specifications should be checked very carefully.

2.15.2 Welded Steel Pipe

Welded steel pipe is usually required to conform to the provisions of Section 70-1.02B of the Standard Specifications.

Review the specifications with the fabricator before fabrication begins, and make sure all special requirements are understood, especially all welding and any NDT requirements. Wrapping and coating with coal tar enamel are often specified. This will normally be done at a different location than where pipe is manufactured. Source inspection will not be necessarily conducted in one location.

2.15.2.1 Sampling and Testing

Check the steel for compliance with specifications. If it is identifiable by heat number, certified mill tests will normally be acceptable and check sampling unnecessary. For unidentifiable material take samples for testing in accordance with the applicable ASTM, AWWA or API specifications.

If the coal tar primer and enamel have not been previously tested or has been furnished by an untested supplier take a one-liter sample of the primer and about a 9-kg sample of the enamel for testing in accordance with the AWWA specifications.

Inspect asbestos felt wrapping visually in accordance with AWWA specifications and take a sample about 2-m long by the width of the roll for laboratory tests. Refer to AWWA C203 for sampling and testing requirements. Certified manufacturer's test reports showing actual test values may be accepted in lieu of sampling and testing.

2.15.2.2 Inspection of Pipe Prior to Wrapping and Coating

Check all phases of fabrication including steel preparation, welding procedures and welder certifications, roll forming of plates, and the actual welding. Require and witness the making of qualification test plates when welders' certifications cannot be verified.

Inspect the finished pipe for dimensions and any base metal and weld defects. Witness any required hydrostatic tests before wrapping and coating whenever possible or obtain certified test reports covering actual tests.

Frequently a supplier may submit fabricated pipe for inspection. In some cases, the pipe may be coated and wrapped, so that even visual inspection of the welds is a problem. The procedure in such cases will vary according to circumstances. Factors to be considered are:

- Quantity
- Proposed use
- Reliability of the manufacturer
- Records available

Small amounts of pipe for a noncritical usage, such as non-pressure application, are sometimes accepted on a Certificate of Compliance and visual inspection; but this should not be a standard procedure. It may be necessary in some cases to cut samples of the steel and obtain transverse weld samples in addition to mill test reports and visual inspection. Check with your supervisor. Be sure in all cases to check dimensions, wall thickness, and quality of welding.

2.15.2.3 Inspection of Wrapping and Coating

The AWWA specifications for surface preparation, wrapping and application of coal tar primer and enamel are very specific. Check all phases of the operation, including preparation of surfaces, priming, wrapping, and application of enamel for compliance with these requirements.

Inspect the finished coating carefully for uniformity and see that it is checked for flaws with an electrical "Holiday" detector when this is required.

2.15.2.4 Reporting

Report the linear measure, diameter and wall thickness, and any coating and wrapping on Report of Inspection Form TL-0029.

2.15.3 Special Metal Pipes and Tubings

Special metal pipe or tubing other than the types previously mentioned may be specified -- for example, aluminum pipe for safety railing. Refer to the contract special provisions and plans for specific requirements. Sampling, testing, and inspection procedures will depend on the specifications for the contract. Check special provisions carefully and make sure materials, dimensions, weights, and workmanship are as specified. Ensure that the pipe wall thickness is of the proper size and any specification requirements for manufacturer's markings are on each joint of pipe. Report quantities (pieces or linear measurement), diameter and wall thickness, and pipe specification on Inspection Report TL-0029.

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2.16 SPECIAL COMPOSITION PIPE PRODUCTS

2.16.1 Plastic Pipe

Plain and corrugated plastic pipe (PVC, Polyethylene, ABS, etc.) is frequently for water supply, irrigation, and drainage, and other special applications. Refer to the contract special provisions and plans for specific requirements.

2.16.1.1 Sampling and Testing

If the pipe is inspected at the place of manufacture, it may be possible to witness the tests required by the governing specification. If pipe has low criticality end use, the certified test reports of an established manufacturer may be accepted in lieu of check sampling. Otherwise, take representative samples as required. Annual tests for burst requirements must be performed by the manufacturer for some pipe applications. Obtain such test report if required. A Certificate of Compliance should be furnished for each shipment.

2.16.1.2 Inspection

Check dimensions (diameter and wall thickness, any markings required by the specifications (usually the manufacturer's I.D., pipe specification and pressure rating and the NSF seal required for pipe conveying potable water), and overall workmanship. Pipe should be homogeneous and free from cracks, holes, and foreign inclusions, and uniform in color.

2.16.1.3 Reporting

Report quantities in length, diameter and wall thickness, and class or pressure rating on Report of Inspection Form TL-0029.

2.16.2 Preformed Fabric Pads

Preformed pads are used under steel bearing plates, usually bridge bearings. As required by Section 55-2.04 of the Standard Specifications, these pads are required to conform to Military Specification MIL-C-882. Pads must meet specified compression tests and a mildew test. Require that the manufacturer furnish a certified test report, including satisfactory mildew test results annually. Most designers now specify elastomeric bearing pads. Source inspection of preformed fabric pads will be very infrequent.

2.16.2.1 Sampling and Testing

In addition to getting the certified test report described above, take a sample of pad material, at least .3-m square, for compression test from each lot supplied.

2.16.2.2 Inspection

Pads will be cut from larger stock size pads. Make thorough visual and dimensional inspection and make sure that the material is homogeneous and the cut edges are straight and true.

2.16.2.3 Reporting

Report number, thickness and dimension of pads released on Report of Inspection Form TL-0029.

2.17 PAINT, EPOXY ADHESIVE, POLYESTER RESINS

2.17.1 General

2.17.1.1 Scope

Requirements for paint are listed in Section 91 Paint and for epoxy adhesives in Section 95 Epoxy of the Standard Specifications. Polyester resins are listed in the contract special provisions. Paints are purchased for bridge paint maintenance and will be purchased by the individual maintenance units on purchase orders. Purchase orders often have special requirements for the paints and specific marking and packaging requirements. The Inspector must review all specifications for the paint order.

Epoxies commonly used for concrete repairs, bonding of anchor bolts, pavement marker adhesives, and injection grouting for concrete repairs will be governed by Section 95. However, the technology of epoxies is constantly improving. Therefore, the Inspector must review the contract special provisions for special applications.

This section covers the sampling and inspection procedures normally required for paints and epoxies, which will also apply to polyester resins.

2.17.1.2 General Information

Source inspection of paint, epoxy adhesives, and polyester resins consists essentially of sampling the raw materials and finished products for testing and later release from approved batches and lots to contracts and purchase orders.

Chemical commodities inspection involves, in addition to sampling, seeing that proper containers are marked as specified, are of proper size and maximum allowable capacity, and making sure that only commodities from tested and approved stock are released. In some cases the Inspector may be instructed by the Chemical Testing Branch to witness the manufacture, reworking, or testing of paint, depending on circumstances and special instructions. A Certificate of Compliance is required from manufacturers certifying that packaging is in compliance with specifications.

2.17.2 Inspection Procedures

2.17.2.1 Sampling and Testing

Review the specifications carefully in advance and make sure the supplier understands what is required. Clarification of requirements and the sampling procedures may be obtained from Chemical Testing Branch. Section 6-1.09 allows the manufacturer to supply materials conforming to the latest specification issue for chemical commodities.

Take representative samples of unmixed raw materials (vehicle, pigment, drier, etc.) when instructed by the Chemical Testing Branch for check test evaluation. The sample size and frequency of sampling shall be as directed. Ensure that all sample containers are properly sealed and packaged for shipment. Sample containers shall be legibly marked with the Inspector's Sample Lot Number, the batch or lot number of the sampled material.

Representative samples of finished batches must be forwarded to the Chemical Testing Branch for testing and approval. Paints should be thoroughly mixed or shaken so samples are actually representative of the finished product. Sample containers must be legibly labeled to the batch number, specification number, and date of manufacture. See that containers are well sealed by means of suitable lid clips, to prevent leakage in transit.

For representative test samples of heavily pigmented paints, an entire randomly selected container of the paint should be taken from the batch which is packaged for shipment. Once the test sample has been drawn from the complete container, the balance will be returned to the manufacturer. Provide the return address on the sample identification card. Primer over 6 months old should be resampled before use. Hard, dry settling, a cause for rejection, often occurs with paints stored for long lengths of time. Any chemical commodity which is beyond its specified shelf life must be resampled for tests.

In preparing the Sample Identification Card (Form TL-0101) to go with the sample, make the information as complete as possible to ensure that the proper tests are conducted. In addition to the Inspector's Lot Number, quantity represented, and other information indicated on the form, give the manufacturer's batch number, date of manufacture, and specification number of the commodity. **A separate SIC TL-0101 must be made for each batch.**

Occasionally very small orders of paint and epoxy (usually under 20 gallons) furnished by vendors of known reliability, are released without sampling. This is a judgment, which should be confirmed with the Inspector's supervisor. In such cases, a Certificate of Compliance must be supplied by the manufacturer.

2.17.2.2 Inspection

Individual shipments for contracts or purchase orders are customarily made from tested and approved stock. Chemical commodities delivered to the job site without formal source inspection releases will be sampled and tested before use.

The Inspector should, in cooperation with the vendor, maintain accurate inventory records of approved batches or lots, registering all shipments from the approved stock.

The manufacturer is required to label all containers with the State Lot Number, specification number, data of manufacture, and his batch number. In addition chemical commodities must be marked as to precautions for shipping and handling.

Tested and approved batches and lots may identified by “Green” Tags or the manufacturer’s labels identifying it to the test Lot Number. The Inspector may release shipments from a tested and approved batches or lot until it is depleted, unless he has reason to believe the material, because of age or for other reasons, may have changed or deteriorated. Resampling may be conducted to ensure that the commodity still complies with specifications.

2.17.2.3 Reporting

Report total volume (liters or gallons), container size, types of paint and epoxy and the specification numbers, batch and lot number, date of manufacturer on the Report of Inspection Form TL-0029. In the case of materials shipped to Maintenance Warehouse stock, special packaging and palletizing may be required. Indicate when materials are palletized.

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2.18 STEEL PILING

2.18.1 General

2.18.1.1 Scope

This section covers steel H-piles, steel sheet piling, and steel pipe for pipe piles. Material specification for steel piles are listed in Section 49-5 of the Standard Specifications with sizes and details shown in the contract special provisions and plans. Sheet piles are usually for special applications so requirements are job specific and must be researched by the Inspector.

2.18.1.2 General Information

In general, acceptance of steel pilings for compressive loadings will only be on the basis of acceptable mill test reports identifiable to the material furnished. Sampling and testing may be required for unidentifiable pile stock.

2.18.2 Steel H-Piling

Most steel H-piling is shipped directly from the steel mill to the job site and will frequently be inspected by the Resident Engineer. Source inspection of warehouse stock may occasionally occur.

2.18.2.1 Sampling and Testing

Obtain certified mill test reports covering chemical and physical tests of all heats. Check H-piles for mill, heat and specification number. If mill test reports are satisfactory and domestic certification is provided, when required, H-piles may be accepted without sampling and testing. If sampling is required, cut a sample from the web of the pile of sufficient width and length for tensile and bend tests. With the exception of high-strength steel piles, H-piles must conform to the requirements of A36. Verify that each pile is permanently marked with the steel mill name or logo. Send samples to the Structural Materials Testing Branch for tests. If the Contractor is willing to pay for independent laboratory tests to expedite the work, such tests may be witnessed by the Inspector with concurrence by the Resident Engineer. Domestic certification shall be provided when required.

2.18.2.2 Inspection

Make visual inspections for dimensions, manufacturer's markings, rejectable surface defects such as laminations, excessive rust, and shipping and handling damage. Verify that heat numbers on listed on furnished certified mill test reports.

2.18.2.3 Reporting

Report total linear quantity, size, number of pieces, specification, steel grade, and heat numbers on Report of Inspection TL-0029.

2.18.3 Sheet Piling

Inspection, sampling, and testing will be dependent on the contract requirements. In general, the same procedures for acceptance of H-piles should be followed.

2.18.3.1 Sampling and Testing

Generally acceptance will be on the basis of identifiable steel sheets to certified test reports which verify compliance with the required specification. Domestic certification will need to be furnished, when required. Unidentifiable steel must be sampled. Tensile check sample coupons, 0.08 m x 0.15 m, shall be taken from each size of sheet pile to corroborate mill test reports. Verify that all required mill markings are on each sheet. Tests may be witnessed at a private laboratory if tests are paid for by the Contractor and that is acceptable to the Resident Engineer.

2.18.3.2 Inspection

Perform visual inspection to check dimensions and required cross section, required mill markings, and for rejectable surface defects per applicable specifications.

2.18.3.3 Reporting

Report total linear quantity, number of pieces, size and cross-section, specification or steel grade, and heat numbers on Report of Inspection TL-0029.

2.18.4 Welded Steel Pipe Piles

As required by Section 49-5 “Steel Piles”, unfilled pipe piles must conform to the requirements of ASTM A 252, Grade 2 or 3. Check the Special Provisions for any changes. Recent seismic strengthening designs require pipe piles to resist tensile and cyclic stress forces. Such piles are required to meet more stringent requirements. Large diameter tension piles, over 42” diameter, are usually produced by special welded fabrication methods, which must comply with special dimensional and welding requirements. Therefore, source inspections of steel pipe piles will vary considerably.

The Inspector must review the contract special provisions and plans before undertaking source inspection. Fabrication inspection will closely follow the same guidelines provided in Part 3 – Welded Steel Structures.

2.18.5 Pile Shells for Filled Concrete Piles

Follow the inspection guidelines for 2.18.4 Welded Steel Pipe Piles.

2.19 COMMODITIES

2.19.1 Scope

This section covers a wide variety of items purchased for State use other than on highway construction. Included are such items as: flagging and other textile materials, furniture, paper, rope, wiping cloths, pens, pencils, floor wax, light bulbs, etc. Because of the many different products and specifications involved, detailed inspection guidelines are not provided in this manual. <u>Inspections for such commodities are now seldom requested by purchasing.</u> The discussion that follows is to provide general direction if commodities source inspections are conducted.

2.19.2 General Information

When source inspection is assigned, specifications, drawings, and special instructions will be forwarded to the Branch Inspection Office. Do not proceed until a copy of the purchase order and specifications are in hand.

2.19.2.1 General Inspection Instructions

Carefully check specifications, drawings, and special instructions included in the purchase order specifications. Review the requirements with the vendor and make sure they are clearly understood. Ask the Office of Structural Materials for clarification of any inspection details that you do not thoroughly understand.

Inspection details will depend on the specifications and on the particular item being inspected. Obtain check samples for tests as required by the specifications. After satisfactory testing of check samples conduct visual inspections of the finished materials for satisfactory workmanship and appearance. Most materials purchased for warehouse stock will require specific labeling and packaging. Be sure that labeling and packaging is in strict conformance with the specifications. Keep the Office of Structural Materials fully informed of all difficulties or unusual developments encountered during your inspection that may result in late delivery.

2.19.2.2 Reporting

Report quantities, description of materials, container sizes, and any special packaging on Report of Inspection Form TL-0029.

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2.20 NEW OR UNUSUAL PRODUCTS

2.20.1 General

2.20.1.1 Scope

It is not feasible in this manual to describe in detail inspection guidelines for all items that may require inspection. The materials used and their properties will not remain constant due to continual improvements in technology and the development of new products which are superior to those presently being used. Items not covered in this manual will the development of new source inspection guidelines and testing. All Inspectors are expected to participate in changes of source inspection guidelines for new products.

2.20.1.2 General Information

For new or unusual items that are not specifically covered in this manual, the similarity of the new product to existing products may allow the use of existing inspection guidelines to be applied. Special instructions must be obtained from the Inspector's supervisor. Request inspection and direction from the Office of Structural Materials.

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Section 3. QA Inspection Guidelines for Concrete Products

3.1 GENERAL SCOPE AND PROCEDURES

3.1.1 Introduction

Precast concrete products comprise a significant portion of materials used in bridge and road construction in California today. An important link between Construction and the precast plant, the QA Inspector not only inspects and reports on a facility's day-to-day operations, but also evaluates a manufacturer's ability to produce a product. The QA Inspector's observations and reports are essential for ensuring precast products meet contract specifications.

Before an inspection can be performed on structural elements, the precast manufacturer must have completed the Caltrans Precast Audit as outlined in Sections 1.14.1 and 1.14.2 of this manual. The audit is intended for structural precast products- including girders, deck slabs and piles – and is not necessarily required for other precast products such as concrete crib wall headers and stretchers, MSE wall panels and reinforced concrete pipe.

Appendix H contains a mandatory checklist to assist the QA Inspector with reporting inspections of structural precast products and precast proponents for retaining walls, sound walls, and culverts over five feet (1.5m) in diameter. Refer to the Standard Specifications and Special Provisions for project specific requirements. Consider the information in this section an additional guideline during inspections.

3.1.2 Scope

The methods in this section are intended to provide general inspection guidelines for the quality assurance inspection of the various precast prestressed (P/C P/S) concrete products frequently required to be inspected. The following outlines subjects which are covered by this section. The Quality Assurance (QA) Plant Inspector must be thoroughly familiar with the following subjects and their governing specifications if a successful and effective quality assurance inspection program is to be carried out:

- Types Of Products
- Plans & Specifications
- Materials (Cement, Aggregates, Admixtures, Prestressing & Reinforcing Steel)
- Prestressing Procedures (Pretensioning & Post-Tensioning)
- Formwork
- Placement Of Bar Reinforcement & Prestressing Steel
- Concrete Mixing And Placing
- Concrete Curing Methods
- Concrete Tests (Penetration, Compression Tests, Air Entrainment, Etc.)

- Concrete Surface Finishing & Repair Methods
- Storage & Loading
- Inspection Records/Documentation

3.1.3 Procedures

The Office of Structural Materials Inspection Coordinator will assign precast plant inspections to the specific Branch Inspection Office. The Inspection Office will be notified by Form DC-CEM-3101, "Notice of Material to be Used." The Inspection Supervisor will then review all contract plans and specifications with the assigned and qualified Plant Inspector, who will be responsible for monitoring all significant plant operations to ensure substantial conformance to the specifications. For new precast plants that have not previously manufactured these products for Caltrans, a prefabrication conference should be scheduled as soon as possible to review the contract requirements. All key plant personnel and their responsibilities should be determined and manufacturing processes reviewed for adequacy. The sources of all concrete and steel materials should be determined and check sampling and testing scheduled to evaluate material conformity prior to fabrication.

The types of inspections typically performed at a precast concrete plant may include, but not be limited to:

- Concrete Materials Sampling
- Batch Plant Inspection
- Rebar Placement Inspection
- Concrete Placement Inspection
- Compressive Strength Witnessing
- Prestressing Inspection
- Repairs of Concrete and/or Coating Witnessing
- Orange Tag Release

The Precast Plant Inspection Checklist is provided in Appendix H to assist the inspector in performing his/her inspection duties. Applicable sections of the checklist should be completed the first time an inspector visits a precast facility and be maintained for the periods in which work is being performed for the State. The checklist shall be available to the Lead Inspector when requested and also available during all QA Lead Verifications completed at the precast facility. Lead Inspector shall verify portions of the checklist during their Lead Verifications.

The following websites may provide additional information to assist the QA inspector during precast concrete inspection activities:

- OSM Forms - http://www.dot.ca.gov/hq/esc/Translab/smbforms.htm
- Construction Manual - http://www.dot.ca.gov/hq/construc/manual2001/

- Prestress Manual - http://www.dot.ca.gov/hq/esc/construction/Manuals/Prestress/Prestress.htm

- Approved Products List - http://www.dot.ca.gov/hq/esc/approved_products_list/

- Index of California Test Methods - http://www.dot.ca.gov/hq/esc/ctms/

Quality Control (QC) inspection is the responsibility of the precast plant. If the specifications require that the plant be certified, the Inspector must make sure that this is verified. The plant's Quality Control Plan (QCP) must also be reviewed for its sufficiency and principle QC personnel identified. If submittals of working drawings are required, the plant must be put on notice that these must be submitted and approved prior to fabrication.

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3.2 TYPES OF PRECAST PRESTRESSED CONCRETE PRODUCTS

In order of their critical structural value, the following lists the types of precast and prestressed concrete products typically used in highway and bridge construction:

- Prestressed Products
  - Bulb Tee Girders
  - Octagonal Piles
  - I Girders
  - Cylinder Piles
  - Square Piles

- Prestressed/Post-Tensioned Products
  - Double Tee Girders
  - Box Girders

- Precast/Post-Tensioned Products
  - Pier Jackets

- Precast Products
  - Bent Cap
  - Drop Inlets
  - Flared-End Concrete Pipe Section
  - Culvert Drains
  - K-Rail
  - RCP Pipe

- Architectural Precast Products
  - Mechanically Stabilized Earth (MSE) Wall Panels

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3.3 SPECIFICATIONS AND PLANS

Contract documents that govern the work are:

- Contract Special Provisions
- Contract Plans
- Caltrans Standard Specifications
- Caltrans Standard Plans
- Approved Working Drawings * (See 3-201)
- California Test Methods

* Submittal of working drawings for the Engineer's approval is required only for members governed by Section 50, Prestressing Concrete of the Standard Specifications, which will apply to all bridge girder members. For prestress piles and other products, working drawings need be submitted only upon the Engineer's request, or as required by the special provisions.

  NOTE: Specifications that govern the work are those in effect on the day the notice to Contractors for the work is dated, unless otherwise stated in the Special Provisions. (Re: Sec. 6-3.01 Standard Specs)

1. Project Plans shall govern over the Standard Plans.
2. Standard Plans and Project Plans shall govern over the Standard Specifications.
3. The Special Provisions shall govern over both the Standard Specifications and Project Plans.

(Re: Sec. 5-1.04 Standard Specs)

3.3.1 Working Drawings

The QA Plant Inspector is responsible for verifying that all precast products are manufactured to the contract plans, or as otherwise approved on the working drawings, when such drawings must be submitted. Unless otherwise required by the special provisions, only those members governed by Section 50 – Prestressed Concrete of the Standard Specifications require working drawings to be submitted for the Engineer's approval. Typically, this would apply to bridge girders, deck slabs, deck units, and special pile designs. Most minor precast products do not require working drawings.

Section 50-1.02 Drawings require that, *"The working drawings of the prestressing system shall show complete details and substantiating calculations of the method and materials the*

Contractor proposes to use in the prestressing operations, including any additions or rearrangement of reinforcing steel and shall include complete specifications and details of the prestressing steel and anchoring devices, working stresses, anchoring stresses, type of ducts, and all other data pertaining to the prestressing operation, including the proposed arrangement of the prestressing steel in the members." The Inspector will verify the placement of mild and prestressing steel and the prestressing force (jack gage pressures & elongation) based on the approved working drawing submittal.

When performing source inspections of prestressing steel systems, the Inspector must verify that the materials released, particularly the post-tensioning anchorages, are the same as shown on the approved working drawings. Specifications allow the Contractor to choose his option for the prestressing methods to be used.

Section 49–3 Precast Prestressed Concrete Piles specifies, *"When requested, the Contractor shall submit two sets of working drawings to the Engineer at the job site for his use in administering the contract. Said drawings shall conform to the requirements of section 5-1.01, Plans and Working Drawings, and shall show the pile dimensions, materials, prestressing methods, tendon rearrangement and working stresses, including any rearrangement of reinforcement from that shown* on the plans." Working drawings for P/C P/S piles are therefore not a mandatory requirement. Piles are constructed to Standard Plan details. Precast plants provide working drawings for their plant use. Copies are often forwarded to the Engineer and provided to the QA Plant Inspector for informational purposes, even though not specifically required.

Dimensions, mild steel reinforcement, and required prestressing forces are usually clearly detailed in the Standard Plans for standard pile sections. Details of lifting loops and steel clearances must be checked by the Inspector. If the precast plant deviates from any contract plan detail, these changes must be submitted on a working drawing submittal for the Engineer's approval.

3.4 PLANT CALIBRATIONS

3.4.1 General

All testing and weighing equipment shall be calibrated to assure that the equipment used for testing is uniform and will provide consistent test results. This section provides calibration information for typical equipment you will likely find at a precast concrete plant.

3.4.2 Batch Plants

All weighing, measuring, and plant control systems must be tested for accuracy at least once per year or after each repair. The procedure for testing and approving batch plants is outlined in California Test 109 – Method for Testing of Weighing and Measuring Devices. The procedure can be found at http://www.dot.ca.gov/hq/esc/ctms/CT_109.pdf.

Batch plant calibration is performed by Caltrans. Batch plants that have been calibrated to California Test 109 will be designated with a sticker that provides at minimum the following information:

- Equipment serial number
- Name of equipment manufacturer
- Name of person who performed calibration
- Date of calibration
- Report number
- Recall date

3.4.3 Compressive Strength Machine

Compressive strength machines are calibrated annually. The procedure for calibrating compressive strength machines is outlined in ASTM E 4 – Force Verification of Testing Machines. Compressive strength machines can be calibrated by an independent laboratory.

3.4.4 Hydraulic Rams and Gauges

Hydraulic rams and gauges are calibrated annually. The calibrations are performed at the Transportation Laboratory. The calibrations are handled in a similar manner as prestressing jacks. Please refer to Section 3.4.6 below for further information. Calibrated lab scales are designated with a sticker that provides at a minimum the following information:

- Equipment serial number
- Name of equipment manufacturer
- Name of company who performed calibration
- Date of calibration

3.4.5 Lab Scales

All weighing systems must be tested for accuracy at least once per year or after each repair. The procedure for testing and approving weighing systems is outlined in California Test 109 – Method for Testing of Weighing and Measuring Devices. Lab scales can be calibrated by an independent laboratory. Calibrated lab scales are designated with a sticker that provides at a minimum the following information:

- Equipment serial number
- Name of equipment manufacturer
- Name of company who performed calibration
- Date of calibration

3.4.6 Prestressing Jack Calibration

Prestressing jacks are calibrated annually. Calibrations of jacks are performed at the Transportation Laboratory. The contractor is responsible for the scheduling of calibration for the jacking equipment and delivering the equipment to the Transportation Laboratory for calibration. Structures Construction maintains current information for jacks used on State approved stressing systems.

The contractor should check all of the high-pressure hoses and equipment (including the jacks) for poor condition or leakage prior to arrival at the Transportation Laboratory. The contractor must check for correct equipment operation prior to arrival at the Transportation Laboratory.

Each jack shall be equipped with two pressure gauges, and each pressure gauge shall be at least six inches in diameter.

The contractor is responsible for calibrating the gauges mechanically with a dead mass tester. Proof of annual calibration must be provided to the Department of Transportation prior to any jacking calibration.

The contractor is responsible for providing sufficient labor, equipment, and material to install and support the jacking equipment and calibration equipment at the Transportation Laboratory and to remove the equipment after calibration is complete.

The contractor is responsible for plotting the calibration results.

Each jack must be calibrated against the load call to at least five different increments. The pressure gauge readings must be recorded for each increment, and the process must be repeated three times.

All gauges must be permanently labeled with the jack ID number.

The Department of Transportation may terminate the calibration at any time if the equipment will not hold pressure, or if a fluid leak occurs.

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3.5 CONTROL OF CONCRETE MATERIALS AND ACCESSORIES

3.5.1 General

The material components typically used in precast prestressed concrete products are Portland Cement concrete, reinforcing steel, welded wire reinforcement, and prestressing steel systems.

A list of prequalified concrete materials and products can be found at http://www.dot.ca.gov/hq/esc/approved_products_list/.

3.5.2 Concrete Materials (Re: Sec. 90 Portland Cement Concrete)

Requirements for component materials (cement, admixtures, mixing water, aggregates, etc.) are specified in Section 90. The following materials must be sampled and tested in order to verify conformance to the specifications:

1. Portland Cement – Type II Modified, or Type III and V when specified. Certificates of Compliance are to be provided by cement mill.
2. Coarse & Fine Aggregates - heavy or lightweight, special provisions may require freeze-thaw requirements for structures at higher elevations.
3. Concrete Admixtures – WRDA, Super Plasticizers, Air-Entraining, etc. must be on Caltrans approved list and used within permitted dosages.
4. Water – for prestressed concrete water for washing aggregates, mixing, and curing must not exceed 650 ppm of chlorides and 1300 ppm of sulfates. Local potable water supplies will usually comply with these chemical restrictions; otherwise, sample for test.

Sampling frequencies shall follow the guidelines in the Department's Construction Manual. If sources for the same materials used by the precast plant are routinely tested for compliance by the local Caltrans District Laboratory, such documented evidence from the District Lab may be used in lieu of QA sampling and testing at the precast plant.

3.5.3 Reinforcing Steel

3.5.3.1 General

Requirements are listed in Section 52 of the Standard Specifications for bar reinforcement, welded wire fabric, reinforcing wire, and epoxy coatings. Additional requirements for epoxy-coated reinforcement are covered in Section 3.5.13 of this manual. ASTM specifications are commonly referred to for the individual materials; however, exceptions must be watched for in the Standard Specifications and contract documents.

Caltrans Certificates of Compliance are required for all mild steel bar reinforcement (ASTM A 615, Gr 60 or A 706/A 706M & A 82 for spiral reinforcement). Deformed bar reinforcement for all major concrete structures must be A 706/A 706M. If not properly certified, obtain check samples and mill test reports.

If epoxy-coated reinforcement is specified, the epoxy coater must supply Certificates of Compliance and check samples as required by Sec. 52-1.02B. Please refer to Section 2.5.5 regarding epoxy coating of reinforcing steel.

3.5.3.2 Inspection

Fabricators shall inform the local Quality Assurance and Source Inspection Branch in advance of all shipments. It will be the Inspection Branch's prerogative when individual shipments will be source-inspected prior to shipment. The State-furnished Fabricator's Certificate of Compliance (Form TL-6024) will be issued to those fabricators who are judged to have adequate in-house quality control. Shipments may be permitted without source inspection. Such shipments will be job-site-inspected by the Resident Engineer and accepted on the basis of the Certificate of Compliance.

The Fabricator shall submit a Certificate of Compliance with each load. Copies will be distributed to the local Quality Assurance and Source Inspection Branch, the Contractor, and one copy retained. While not every shipment need be inspected under this system, periodic inspections must be conducted by the local Quality Assurance and Source Inspection Branch to ensure mill markings are acceptable, bending of bars conform to the required ACI radii, and the storage condition of the steel is adequate to ensure it is clean from deleterious material which might be detrimental to the bonding of concrete. The Inspector shall initial and date the certificates for those shipments source inspection has been performed. Steel heat numbers should be verified during source inspections by reviewing the certified mill test reports in the fabricator's file. Verify that steel is furnished to the required ASTM specification and that it is domestic manufactured, when so required.

When reinforcing steel is joined by welding or mechanical coupling at the fabrication plant, the local Quality Assurance and Source Inspection Branch is responsible for inspecting this operation, including sampling, testing, and visual inspection. Procedures for inspecting and testing of welded and mechanical coupled reinforcement bars are found elsewhere in this manual. Coupled and welded joints are to be itemized on the Certificate of Compliance. The Resident Engineer may request that the Inspector issue a supplemental TL-0029, Report of Inspection.

When spot checking, check for overall workmanship including required bar markings. Excessively heavy rust and/or excessive scabby mill scale is not acceptable. Inspect fabricated bars for cracks at the bends. Spot check heat numbers and mill test reports to see that the proper grade of steel is being supplied and heat identification is being maintained. Spot check certificates for accuracy and completeness.

3.5.3.3 Sampling and Testing

Check samples should be taken once every three months from each fabricator. Sample at least one tensile and one bend sample for each mill supplier per bar size. Send copies of certified mill test reports along with sampled bars to the Laboratory. Bars will be physically tested for conformance to the designated ASTM specification. Chemical analysis must be performed annually. Indicate on your Sample Card TL-0101 when annual chemical tests are to be performed.

3.5.3.4 Acceptance of Certification

The fabricator may issue certificates of compliance as stated in Caltrans Standard Specification Section 6-1.07 "Certificates of Compliance" based on evidence of consistently satisfactory check sample testing of the supplying steel mills as well as consistent and acceptable quality control being exercised. Certificates of compliance must be signed by a responsible representative of the fabricator.

If a check sample fails, the fabricator and the mill should be immediately notified. Submit two additional samples of steel from the same mill that supplied the failing check samples. The fabricator should also be informed of non-conforming items such as improper quality control and improper storage of material, resulting in excessive contamination of steel. Repeated failures of check samples or repeated problems with the fabricator's quality control or improper storage should be discussed with the Inspector's supervisor to determine what course of action should be taken. The fabricator's certification privileges may be withdrawn for continual failure to provide acceptable quality control or non-conforming material and poor workmanship. The decision shall come from the Resident Engineer.

3.5.3.5 Reporting and Shipping

No tagging or the issuing of inspection reports will be required unless the certification privilege is revoked by the Resident Engineer. Copies of certifications for all shipments will be furnished for the files of the Resident Engineer, the responsible local Quality Assurance and Source Inspection Branch, and the Office of Structural Materials. The Resident Engineer's copy will be furnished with the shipment. Inspectors who perform random spot checks of shipments must initial and date the fabricator's certifications for the shipment. Domestic certification must be provided if the contract is governed by the Buy America Act and may be included on the fabricator's certification.

3.5.4 Welded Wire Fabric and Bare Wire Reinforcement

3.5.4.1 General

Welded wire fabric and wire reinforcement may be accepted on a Certificate of Compliance. Take periodic check samples in accordance with specifications, except that one sample will be sufficient to represent a lot. Stock sizes of welded wire fabric are normally supplied to

ASTM Designation A 185. Fabric may also be specified to be hot-dip galvanized or epoxy coated. Requirements for epoxy-coated welded wire fabric are contained in Section 2-110. Reinforcing wire is normally specified to ASTM A 82.

3.5.4.2 Dimensions/Marking Inspection

Check wire gauge, dimensions, spacing, and fabric welds for conformance with specifications. Plain wire fabric or fabric galvanized, either before or after fabrication, may be furnished. Check the contract specifications to ensure galvanizing is correctly furnished. Each roll of fabric shall bear the manufacturer's tag that will provide the specifications number, size and spacing of wires, and galvanizing class, when galvanized. Reinforcing wire is normally supplied in coils and will bear the name of the steel mill, heat number, and gage. Buy America statements should also be checked for contracts requiring domestic steel.

3.5.4.3 Workmanship Inspection (Visual)

Visually inspect the wire for defects such as open seams, rust pitting, etc. The welds in wire fabric should be completely fused and contain no cracks at the wire intersections.

3.5.4.4 Reporting

A Certificate of Compliance, accompanied by the originating mills certified test report, are the only documents required. Epoxy and galvanized coatings must also be certified. Domestic certification must be supplied when required.

3.5.5 Prestressing Steel and Prestressing System Components

3.5.5.1 General

Prestressing steel is used in the construction of prestressed concrete members. Members may be cast in precast plants or on the job site. The type of prestressing steel and prestressing methods used (pretensioning or post-tensioning) are at the Contractor's option. These options are detailed on approved working drawing submittals or specified in the contract plans for prestressed concrete piles. Requirements for prestressing steel are listed in Section 50 of the Standard Specifications. Commonly used prestressing steel and reference ASTM specifications are:

- Prestressing Strand: ASTMA 416 (Low-relaxation type)
- Prestressing Bar: ASTM A722 (Type 1 Plain & Type 2 Deformed)
- Prestressing Wire: ASTM A421
- Epoxy-coated Strand: ASTM A882

Most prestressing steel used in field construction is post-tensioned and the anchorages used must be State approved. Prestressing steel used for tie-backs and tie-downs is PVC sheathed and coated with corrosion inhibiting grease. Prestressing steel, anchorages, and tendon components are required to be source inspected, sampled, and tested as these are critical components when used in bridge members.

Note: "Buy America" Certification must also be provided for all steel members when so required.

3.5.5.2 Inspection, Sampling, and Testing

The Contractor must submit working drawings for the review and approval of the Resident Engineer for prestressed concrete structures. The method and materials used to prestress concrete are detailed in the approved working drawings. The Inspector must review the approved working drawings in order to competently conduct check sampling and inspection of the prestressing steel and components released to specific projects. Samples of prestressing steel must be submitted from the actual heats and lots to be used on the project or at the precast plant. Follow the sampling instructions in Section 50-1.10.

- For wire: one 2-m long sample of each size for each heat or reel.
- For bars: one 2-m long sample of each size for each heat or real. In addition, if couplers are to be used with the bar, two 1.25-m long samples of bar, equipped with one coupler and fabricated to fit the coupler
- For strand: one 1.5-m long sample of each size for each heat or reel
- For epoxy-coated strand: one 1.5-m long sample of uncoated strand of each size for each heat or reel. In addition to the strand sample required by Section 50-1.10, four 1.5-m long samples of coated strand and one 1.5-m long sample of uncoated strand of each size and for each heat or reel must be furnished to the RE for testing.

Prestressing strand is normally furnished by the contractor for testing. Samples must betaken from each size and each heat of prestressing bars, from each manufactured reel of prestressing steel strand, and from each coil of prestressing wire. The manufacturer's certified test report must accompany each check sample submitted for testing. The test number for the sampled lot is also provided by the manufacturer. A list of the approved coils with the associated test number is supplied to each local Quality Assurance and Source Inspection (QASI) Branch. Coils that can be verified by the laboratory-approved list may be accepted without further sampling. Strand furnished directly to prestress plants without proper release should be brought to the attention of the QASI branch senior for resolution, even if the inspector verified that the coil had been tested and passed by the Structural Materials Lab (Lab). A Contract Change Order (CCO)will be needed for the release of material that is shipped to the job site prior to being tested and approved by the Lab.

Prior to releasing (tagging) prestressing steel, the inspector should verify that the samples representing the coils have been tested and passed by the Lab, and that the manufacturer certified test results (including A&E values) are securely attached to each coil. The A & E test values are needed by the Resident Engineer in order to accurately calculate the elongations of prestressing steel during the prestressing operation.

For prestressing steel not tested by the Lab and delivered directly to a project from out-of-state manufacturers, sampling and releasing by OSM inspector must be approved by the QASI branch senior on a case-by-case basis.

Prestressing tendons for tiebacks and tie-downs are generally pre-greased and installed in PVC and metal ducts and often pre-grouted. The corrosion inhibiting grease must be sampled and approved prior to its use. Brands of grease previously tested and approved may be used on the manufacturer's certification. HDPE sheathing and the PVC corrugated duct must be verified for specification conformance. The pre-grouted prestressing tendons must be source inspected, tagged and released to the project.

Prestressing steel samples submitted for tests must be properly identified on the TL-0101 Sample Card to coil and heat numbers and accompanied by the manufacturers' certified test reports and domestic certification when so required.

Epoxy coating material for epoxy-coated strand must be on the Department's list of approved coating materials. Before coating the strand, the Contractor submits to the Translab a 230-g sample from each batch of epoxy coating material to be used. In addition to the strand sample required by Section 50-1.10, four 1.5-m long samples of coated strand and one 1.5-m long sample of uncoated strand of each size and reel must be furnished to the RE for testing

3.5.5.3 Storage of Prestressing Steel

All prestressing steel shall be stored in such a manner that it will be protected from corrosion and contamination until its use.

Prestressing strand is required to be shipped in corrosive resistant packaging ("Cal-Pak"), and be stored in a protected area where it cannot come in contact with the sparks generated by electric arc welding or oxygen acetylene cutting torch. Sparks landing on this type of steel can cause irreversible damage. The specifications require that prestressing steel shall be protected against rust and that it shall be free of dirt, rust, oils or other harmful substances when installed. Therefore, protective measures must be maintained, and the condition of the steel must be checked by the Inspector. Special care must be taken to see that required protective wrapping, corrosion inhibitors, and storage facilities are used.

The following is presented as a guide for inspection of prestressed steel for corrosion (i.e. rust) before installation in ducts:

1. Upon opening, if there is an even coating of rust over the strands in the entire pack, the pack should be rejected. This situation indicates improper handling or storage.
2. If there are one or more wires in a strand which shows extensive rust throughout its length, the entire pack should be rejected. The wire was probably rusted when the strand was wound.
3. When there are spots of rust on a portion of strands in the pack, especially on the inside of the coil, this is the likely effect of condensation, usually caused by temperature changes during shipment or storage. If these spots can be removed by rubbing or scraping with the fingernail, the steel is acceptable. If light streaks of rust remain, the steel is still acceptable if pitting is not present.
4. Short sections of strand which contain clinging rusts, pits, or other flaws should be rejected without rejecting the entire pack.

The above criteria can generally be applied to rods as well as strand. In addition, any loose mill scale on rods should be removed in a manner that will not damage the material. Prior to rejecting prestress steel, contact the Structure Representative and the SMR immediately.

It is required that the prestressing steel be checked for rust and other flaws, as described above, while the tendons are being made up and before placing in the ducts. During the placement operation, inspection should also be provided for proper make-up of tendons, and for care in keeping the steel and ducts clean and free from any foreign material or damage from handling.

Prestressing strand used in precast prestress plants must be sampled and tested for specification compliance unless previously tested by the Structural Materials Testing Branch. Strand may have been approved for Caltrans Stock at the manufacturing plant or a warehouse location prior to delivery. The precast plant Inspector may accept prestress strand if the pack and heat numbers are listed on the Office of Structural Materials approved lists. The “E” value and “A” actual steel area must be furnished to the Precast Plant Engineer to finalize prestressing calculations. Once the corrosion resistant packaging is broken, the Inspector must see that the strand is adequately stored to protect it from corrosion and other contamination.

A corrosion inhibitor must be applied if prestressing steel is placed in ducts prior to placing and curing concrete. If the steel is placed after placement of the concrete, a corrosion inhibitor shall be required if the stressing and grouting are not completed within 10 days. The contractor shall provide an approved corrosion inhibitor which prevents rust or corrosion.

3.5.5.4 Reporting

Record the quantity, size and type of prestressing steel, reel or heat numbers, and if the prestressing strand is low-relaxation type.

3.5.6 Post-Tensioning Anchorages

3.5.6.1 General

Before releasing post-tensioning anchorages, verify that the anchorage model has been tested and approved by the Office of Structural Materials. Approval is accomplished by a formal procedure wherein the manufacturer submits drawings and specified data on materials, quality control, etc., in addition to making a complete unit available for testing and evaluation. A set of detail drawings for the approved anchorage system, data on materials, and quality control procedures submitted by the manufacturer will be provided each local Quality Assurance and Source Inspection Branch to facilitate source inspection. These drawing details must be reviewed prior to the inspection and releasure of the anchorages.

3.5.6.2 Inspection

To inspect approved anchorage units, check for conformance to the details, material specifications, and quality control procedures that have been approved. This will generally include such steps as the following:

- Get a Certificate of Compliance for each shipment.

- Check materials used for conformance to the manufacturer's approved details and material specifications. Obtain mill test reports and take periodic check samples of anchorage steel, particularly castings, and serrated teeth wedges. Each manufacturer's lot of wedges must be sampled for dimensional checks and metallographic examination by the Office of Structural Materials. Bearing plates for anchorages are accepted on certified mill test reports.

- Some anchorage components are cast steel. The casting foundry must supply certified test reports and heat treatment records. Samples (test coupons) must be supplied by the foundry. These samples are to be sent to the Office of Structural Materials for testing of physical properties and dimensions to verify compliance with the approved design.

- If nondestructive testing (NDT), usually MT, is listed as part of the manufacturer's approved quality control procedures, verify that this has been performed and obtain copies of the NDT report.

- Every effort must be made to ensure that the approved quality control procedures are being performed. These will include checks of general dimensions and physical tests. Post-tensioning ducts, grouting and venting hardware are usually standard details. Tie-back and tie-down anchorages often specify contract specific details. Special details should be checked against approved drawings.

Inspectors assigned to precast prestress plants must verify that all post-tensioning anchorages and tendon components have been inspected and released at the point of manufacturer and conform to the approved working drawings.

3.5.6.3 Reporting

Tag and release acceptable material and report quantities of post-tensioning anchorage components and the manufacturer's model numbers supplied. The supplier will generally supply an itemized list of components being shipped, which can be attached to the Report of Inspection TL-0029.

3.5.7 Concrete Inserts

3.5.7.1 General

Inserts are used in precast concrete for several reasons. Inserts are primarily used to remove products from the form and to handle and erect products in the field. They are also used to connect precast concrete products to adjacent structural or architectural elements. The following sections describe the types of inserts typically found in precast concrete products.

3.5.7.2 Harp Hold Downs

Hold downs secure prestressing strands at harp points along the length of the strands. Harp points are points of maximum moment or maximum stress in the member.

Harps are typically field released by the Engineer on a Certificate of Compliance. They will generally not have release tags attached when they arrive on the jobsite. Damaged hold downs should be rejected unless damage is minor and they have been approved by the Engineer.

The locations of these points are critical so their placement must be carefully checked against the Contract Drawings.

3.5.7.3 High Strength Rods

High strength rods should have green release tags attached when they arrive on the jobsite. The high strength rods are to be checked for specification compliance and any damage that may have occurred during shipping, particularly if they are coated and/or threaded. Damaged rods should be rejected unless the damage is minor and they have been approved by the Engineer. If coatings are to be repaired, then repair procedures approved by the Engineer should be used.

3.5.7.4 Steel Plates

Steel plates are typically used for the connection of products to adjacent structural or architectural elements. Plates with anchors welded to them are generally called assemblies or weldments.

Weldments should have green release tags attached when they arrive on the jobsite. The weldments are to be checked for specification compliance and any damage that may have occurred during shipping. Damaged weldments should be rejected unless the damage is minor and they have been approved by the Engineer.

The quality of the welds and accuracy of the fabrication are critical for weldments. Welded steel products are further discussed in Section 4 of this document.

3.5.7.4(1) Bolts, Nuts, and Washers

Bolts, nuts, and washers should have green release tags attached when they arrive on the jobsite. The bolts, nuts, and washers are to be checked for specification compliance and any damage that may have occurred during shipping. Damaged bolts, nuts, and washers should be rejected unless the damage is minor and they have been approved by the Engineer.

Additional information related to bolts, nuts, and washers can be found in Section 2.3.9 of this document.

3.5.7.4(2) Lifting Devices

Lifting devices are inserted in precast products in order to remove the products from the forms and handle and erect products in the field.

Lifting devices can be either shipped from a supplier or fabricated at the precast plant. Lifting devices that are provided by a supplier are typically field released by the Engineer on a Certificate of Compliance. They will generally not have release tags attached when they arrive on the jobsite. Lifting devices should be checked to ensure their locations conform to the shop drawings. Lifting loops should project an equal distance from the surface of a product and square with the surface of the product. Offset and misplaced lifting loops can cause tilting of the product during lifting which may lead binding in the form. Binding of the product may lead to cracking and spalling of the product or failure of the lifting insert.

3.5.7.4(3) Ducts for Prestressing Steel

Section 50-1.07 of the Standard Specifications requires that duct enclosures for prestressing steel be rigid ferrous metal, galvanized, mortar tight, and accurately placed as shown on the Contract Plans or approved by the Engineer. There are generally three types of rigid ducts:

- **Smooth wall type** - made from strip steel held together longitudinally with a continuous resistance weld or a continuous interlocking seam

- **Ribbed type** – made from ribbed sheet steel with helically would interlocking seams
- **VSL shallow elliptical or rectangular type** – occasionally used for transverse deck stressing

The rigid ducts are to be field released by the Engineer on a Certificate of Compliance. The ducts will not have release tags attached when they arrive on the jobsite. The ducts are to be checked for specification compliance and any damage that may have occurred during shipping. Damaged duct can be repaired if the damage is minor but shall be rejected if the damage is extensive.

Placement of ducts shall be compared to the Contract Plans. The final check for duct alignment should be verified by eyeballing for a smooth tendon path.

Waterproof tape shall be used at all duct connections. It is recommended that taped duct joints be staggered for multiple tendon girders for that misalignment of the ducts does not occur.

Duct vents are required on ducts with a total length of 400 feet or more and shall be located within 6 feet of a high point in the duct profile.

The Contractor is required to protect the ducts from any water or debris entering them prior to placement of the stressing steel.

3.5.8 Expansion Joint Fillers

Usually each vendor's stock of expansion joint filler meeting specification requirements will be sampled, tested and set up as pre-approved State tested stock from which various orders may be filled. Additional stock samples will be periodically taken or when the vendor's stock is replenished. Requirements for expansion joint fillers are listed in Section 51-1.12 of the Standard Specifications or the Special Provisions.

3.5.8.1 Special Joint Filler

Often special joint filler varying in quality from that covered by the Standard Specifications is specified. Material of this type is subject to sampling and testing for each project before acceptance as it is not an ordinary stock item.

3.5.8.2 Sampling and Testing

Samples will be cut from sheets representative of the material being sampled. A minimum of two samples will be taken for each thickness of material offered. When practical, samples may be cut full width of the sheet. The number of samples required depends on the uniformity of the product being sampled and the amount of material represented.

3.5.8.3 Inspection

Inspect individual orders for size, clean cutting when cut to detail and any excessive damage due to handling or storage. Sections fastened together with clips are not acceptable unless specific permission has been granted for their use. Defects such as tears, brittleness, excessive drying out, etc., are not allowable.

3.5.8.4 Reporting

Attach inspection tags to acceptable material and report shipments as to quantity and size shipped on the Report of Inspection TL-0029.

3.5.9 Waterstop

3.5.9.1 Sampling and Testing

Standard waterstop is made of neoprene or polyvinylchloride (PVC). PVC waterstop is usually preformed to a specific cross-section. Strip waterstop is made of neoprene. General requirements for waterstop are listed in Section 51-1.14 of the Standard Specifications. Check the project specifications for type and size of waterstop required. Existing manufactured stock will be sampled by cutting at least one full width section from each lot of the material offered. Waterstop is furnished in coils and is identified intermittently through its length with the manufacturer's ID and the batch or lot number. Material which shows indication of damage in storage or handling will not be acceptable and should not be sampled or accepted. Obtain a Certification of Compliance from the manufacturer if called for by the specifications.

3.5.9.2 Inspection

Check the material for dimension, finish, and uniformity. The waterstop dimensions must conform to the dimensions shown on the plans, within the specified tolerances. Waterstop may be furnished from pre-approved stock or sampled for specific contracts. If in doubt as to dimensional conformance, send in two representative samples for checking, and indicate on the TL-0101 that you want a dimensional check. Waterstop shall be furnished full length for each straight portion of the construction joint. Manufacturer's shop splices shall be fully vulcanized.

3.5.9.3 Reporting

Tag and release acceptable materials. Record quantities, size, and type of waterstop on the Report of Inspection TL-0029. (See memo for policy for Inspection, Testing and Release of Strip Waterstop, 2/2/98).

3.5.10 Elastomeric Bearing Pads (Steel & Fabric Reinforced)

3.5.10.1 General

The general requirements for elastomeric bearing pads can be found in Section 51-1.12H of the Standard Specifications. Steel-laminated pads must conform to an amended version of ASTM D 4014. Elastomeric bearing pads are customarily used as bridge bearings. They are designed to accommodate expansion and contraction movements of the bridge due to temperature change. Elastomeric bearing pads may also be used in the construction of seismic isolation bearings and in combination with PTFE and spherical bearings that are designed to accommodate the angular rotation of bridge members. When used to support bridge members, they are considered critical components and as such must be subjected to check sampling and testing and close visual inspection and testing to ensure compliance with specification requirements and the contract plan details.

3.5.10.2 Inspection

For bridges, elastomeric pads are of laminated (layered) construction with either fabric or steel reinforcement between the neoprene rubber layers. The maximum thickness of individual layers is 12.5 mm (1/2") and the layers must be vulcanized to the required dimensions. The dimensions of completed bearing pads must be closely checked to ensure they are within the dimensional tolerances of the specifications. Check the project specifications for type and size of bearing pads required.

Elastomeric bearing pads are constructed of neoprene rubber. Pads over 12.5 mm (1/2") must be of laminated construction. Laminated pads consist of alternate layers of elastomer (neoprene rubber) and fabric or steel reinforcement. The neoprene rubber and the fabric or steel reinforcement must be evaluated. Component materials must be evaluated by check sampling or certified test reports furnished by the manufacturer.

3.5.10.3 Sampling and Testing

Check samples of completed pads must be furnished from each manufactured lot of pads. The number and size of sample pads shall be that listed in the contract special provisions. Obtain a Certificate of Compliance together with a certified report of the manufacturer's tests. The certification and test report shall be sent with the check samples to the Office of Structural Materials and copies retained in the local Quality Assurance and Source Inspection Branch file. Because of the complexity of testing, specifications require that pads be available for sampling 3 weeks in advance of intended use.

Steel reinforced bearing pads are molded and vulcanized to the specific dimensions for contracts. Internal steel shim reinforcement must have a minimum elastomer cover of 3 mm at their edges to provide corrosion protection. A full size pad is sampled for testing. For pads greater than 2” in thickness, the manufacturer must furnish a cut sample from the center of the pad which is 2.25 inches thick x 8 in. x 12 in. Often the pads will be shipped directly to the job site from an out-of-state source. In such cases, a sample pad will be submitted by the manufacturer to the Laboratory in Sacramento for testing prior to shipment to the job site. Our Laboratory will perform QA tests to evaluate the bearing pad, and a copy of the report is then sent to the local Quality Assurance and Source Inspection Branch.

Fabric reinforced pads are made as stock sheets of specific thickness. Pads are cut from these stock sheets to required plan dimensions. Existing manufactured stock will be sampled by taking at least one sample from each size or lot of fabric reinforced material and generally designated as pre-approved stock, if acceptable. Pads that show indications of damage in storage or handling will not be acceptable and should not be sampled for highway use without special permission. Dimensional checks shall be made to ensure the overall dimensions and laminated layers are within specification tolerances. (See memo in Appendices on policy for Inspection of Fiberglass Reinforced Elastomeric Bearing Pads, 8/27/97).

3.5.10.4 Reporting

Pads which have passed visual inspection, check tests, and for which the required certifications and certified test reports have been furnished may be tagged and released. Report number of pads released, dimensions, and type (fabric or steel reinforced) on the Report of Inspection TL-0029.

3.5.11 Sealed Joints

3.5.11.1 General

Requirements for sealed joints are specified in Section 51-1.12Fof the Standard Specifications. Joint seals generally fall under three types:

1. Type A, a field mixed polyurethane or silicone sealant.
2. Type B, a preformed Elastomeric joint seal.
3. Joint Seal Assemblies that consist of a metal casing used in conjunction with an Elastomeric piece to be anchored into a recess above the concrete joint.

The Chemical Testing Branch is responsible for testing Type A joint seal materials. The Structural Materials Testing Branch (SMTB) is responsible for testing Type B joint seals. Each Type B joint seal manufacturer sends a 1-meter long sample from each lot, along with a Certificate of Compliance and certified test results. The SMTB tests the Elastomeric material and issues a report to the manufacturer. Test results for both types are returned to the manufacturer in about three weeks. The manufacturer can then ship the materials to the jobsite for release by the RE.

3.5.11.2 Inspection

OSM may periodically visit joint seal assembly manufacturers to review the manufacturer's quality control procedures and ensure the exercise of good quality control. The inspector may be aware of all requirements in the contract documents. The following are highlights for inspecting joint seal assemblies:

- They shall be furnished per the plans and as specified in the special provisions.
- When inspecting verify they are manufactured to approved shop drawings.
- Verify that preformed Elastomeric component is sent by manufacturer's lot number to Sacramento Lab for testing (generally done by manufacturer). The Sacramento Lab issues a report to the manufacturer for passing material. This report contains test information and movement rating.
- Steel fabrication is done in accordance with Section 75-1.03 Miscellaneous Bridge Metal.
- Welding is performed to the requirements of AWS D1.1. This generally consists of fillet and stud welds.

3.5.11.3 Reporting

Joint seals assemblies will not be sampled, however the Elastomeric component should be sent to the Sacramento Lab for testing by the manufacturer, prior to inspection. Once the Inspector verifies all items in the inspection requirements, a TL-29 shall be generated for any orange tag release. Information reported on the TL-29 shall include linear quantity, size and movement rating of joint seal assemblies.

3.5.12 Concrete Curing Compounds

3.5.12.1 General

All curing compounds now being used are water-based because of environmental concerns. General requirements for curing compounds are listed Section 90-7.01B of the Standard Specifications These requirements are usually superseded by the special provisions or a no-cost Contract Change Order. This Change Order outlines the sampling and testing procedures in reference to Division of Construction Directive CPD 01-13 dated October 23, 2001, and the Department letter to Western States American Concrete Pavement Association (WSCAPA) dated October 23, 2001. These procedures are stated in the following sections.

3.5.12.2 Sampling, Testing, and Inspection

According to Division of Construction Directive CPD 01-13:

1. Resident Engineer (RE) shall issue no-cost Change Order on sampling and testing of curing compound.

2. The manufacturer of curing compound shall perform the required quality control tests on each batch of curing compound and report results on the specified certificate of compliance (COC).
3. The manufacturer will also perform three "fingerprint tests" on test samples obtained from shipping containers (totes/drums) for each batch and report test results on the same COC.
4. Split samples are sent from the batch and shipping containers to the Chemistry Lab in Sacramento along with the COC. The Chemistry Lab may test the samples to verify manufacturer's test results.
5. METS source inspectors will release shipments of curing compound based on an acceptable CCO, and after verifying the batch log of shipments to ensure that the shipment is part of that batch and the cumulative amount of shipments has not exceeded the batch amount.
6. The Resident Engineer (RE) shall obtain field samples for each shipment, or each time a brand is changed and will be sent to the Lab for testing.
7. The Lab will test field samples, sampled and submitted by the RE, as a first priority. Test results determined by the Chemistry Lab will be reported to the RE.
8. The RE shall order the contractor to cease the use of non-complying curing compound. Production of PCC paving shall only continue after the RE is assured that the cure as applied complies with specification.

Note: METS Source Inspectors will no longer release (tag) shipments are the source as stated above in Step 5. Future periodic sampling at the source and testing could occur as per new materials assessment and management procedure.

3.5.12.3 Reporting

Pending new materials assessment and management procedure

3.5.13 Epoxy Coating for Reinforcing Steel

3.5.13.1 General

Requirements for epoxy coating of reinforcing bar, reinforcing wire and welded wire fabric are detailed in Section 52-1.02B of the Standard Specifications, and Section 10-1.XX Reinforcement of the Special Provisions. These specifications will generally refer to the following ASTM Specifications that cover requirements for epoxy-coated steel:

- A 775 Epoxy-Coated Steel Reinforcing Bars
- A884 Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement
- A934 Epoxy-Coated Prefabricated Steel Reinforcing Bars
- D3963 Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars

3.5.13.2 Inspection

Inspection visits shall be made by Office of Structural Materials to review the coater's quality cont5rol procedures and ensure that the epoxy coater is exercising good quality control. The inspector shall be aware of all requirements per contract document, the following are highlights for inspecting epoxy coatings:

- Ensure that the coater has submitted a sample of the epoxy powder (110-g sample per batch) used in production directly to the Sacramento Lab with the required certifications for acceptance testing prior to use (Standard Specifications 52-1.02B). The Lab will generally fax test results to the coater seven to ten days after receipt by batch number and product ID.
- Verify that bar identity (heat numbers) are maintained during the coating operation.
- Verify that the coater is adhering to *Surface Preparation and Coating Application* of the applicable ASTM.
- Verify that the coater is adhering to *Requirements*… of the applicable ASTM. Review recorded documents of these tests.
- Verify that the coater is adhering to *Handling and Identification*… of the applicable ASTM.
- Get a copy of the Certificate of Compliance for any material shipped.
- Rejected material shall be marked per *Rejection* of the applicable ASTM

3.5.13.3 Sampling and Reporting

The inspector, when taking samples for testing by the Structural Materials Testing Branch of METS, shall adhere to the following:

- Samples are representative of the material to be shipped.
- Samples are the size required by contract documents (typically two 700-mm long samples for reinforcing bar or wire reinforcement).
- Samples clearly identified with Inspector's lot number and coater's tracking number.
- Accurate TL-0101 accompanied by COCs, QC test results and mill certifications.

Once the Inspector receives acceptable test results for the Structural Materials Testing Branch of METS, the material shall be tagged for shipment and a completed TL-0029 provided to the Resident Engineer or a completed TL-6011 filed appropriately.

In the event of failing test results, the Inspector shall inform the coater immediately. If the contractor requests retesting, additional samples shall be taken in accordance with the retesting requirements of the special provisions. At no time is the material to be tagged without confirmation of passing test results from the Structural Materials Testing Branch of METS.

Each TL-0101 shall be assigned a log number appropriate for the Inspector sampling the material. The TL-0029 or TL-6011 releasing the material for shipment shall reference the lot number(s) assigned to the representative sample(s). In the event that retesting is performed, the new samples shall be given the same lot number as the original sample with an "R" added to the end. For example, if a failing sample had the lot number B01-123-04R, the sample for retests shall be given the lot number B01-123-04R.

3.6 PRESTRESSING PROCEDURES

3.6.1 Prestressing Requirements (Re: Sec. 50-1.08 Prestressing)

Prestressing requirements, unless superseded by the special provisions or contract plans, are specified in Section 50-1.08. Additional information related to prestressing is provided in the Prestress Manual which can be found at:

http://www.dot.ca.gov/hq/esc/construction/Manuals/Prestress/Prestress.htm

Prestressing may be performed by either pretensioning or post-tensioning; this option is provided to the Contractor. Pretensioning is the predominant method used by established precast prestress plants. Post-tensioning is used principally for jobsite construction or when only a few members are required, and it is economically prohibitive for the precast plant to build casting beds for only a few members. Inspectors must be familiar with both prestressing methods.

Prestress steel should preferably be cut with a carborundum blade. Flame cutting may be used provided proper care can be exercised near anchorages. Cold-chiseling should be avoided near anchorages.

3.6.2 Prestressing Calculations

Calculation of the required prestressing force (jack gage pressure) and the tendon elongation are the Plant's responsibility. These must be submitted as part of the required working drawing submittals and must be approved by the Engineer. Working drawings for piles are only required when requested by the Engineer. The Standard Plans specify the required prestressing strand area and prestressing forces for standard piles. The Inspector is responsible for verifying that jack gage pressures and tendon elongations are adjusted for the actual modulus of elasticity ("E") and steel area ("A") and actual bed lengths and geometry.

3.6.3 Post-Tensioning (Re: Sec. 50-1.08)

Although most precast plants will use the pretensioning method to fabricate prestressed concrete members, there will be occasions where post-tensioning will be used. Therefore, the Inspector must be qualified to monitor the post-tensioning and grouting of the precast tendons. The submitted post-tensioning calculations are based on the theoretical parabolic positioning of the tendon and friction and wobble effect of the duct. In addition, anchorage seating losses must also be accounted for, and the Inspector shall inspect for excessive anchorage seating losses.

Failure of the theoretical tendon elongation and jack gage pressures to agree will indicate that tendon positioning and calculated friction losses are incorrect. The Inspector should notify the Plant QC inspector if this happens and request that the precast plant investigate the discrepancies. Qualified Inspectors must be able to review the stressing calculations and the necessary corrections to gage pressure and elongation.

Post-tensioning steel is required to be placed after steam curing. Semi-rigid steel ducts are held in position during casting with steel pipes which are withdrawn after concrete has hardened. Placement of the post-tensioned tendon, stressing, and grouting shall be completed within 10 days of initial casting. Post-tensioning of simple span girders may be performed from one end.

3.6.4 Prestressing and Detensioning Tendons

The following requirements must be verified by the QA Inspector during prestressing and detensioning of tendons:

- A current calibration curve must be furnished for each jack & gage combination. The pressure gage must have a minimum diameter of 6". Calibrated load cells can be used in lieu of pressure gages. A minimum of two pressure gages may be specified by the special provisions.
- Maximum temporary jacking stress shall not exceed 75% of GUTS.
- Initial jacking stress for pretension members shall not exceed 70% of GUTS (Guaranteed Ultimate Tensile Strength).
- For pretensioned members that are single strand stressed, the Contractor must check for loss of prestress if concrete in not placed within 3 hours of pretensioning.
- Pretensioning is the most common method used by precast plants; However, the QA Inspector must be knowledgeable of the specific requirements for post-tensioning and grouting of these tendons.
- The locations of prestressing tendons, particularly those in girders, must be closely checked to ensure their placement agrees with those in the approved working drawing. For girders with deflected strand patterns, inaccurate placement can result in lateral eccentricities and inconsistent girder camber. If the required C.G.S. of the strand pattern is set excessively high, the design capacity of the girder will suffer.
- Pretensioned prestressing strand exposed to the elements for more than 36 hours shall be protected form contamination & corrosion.
- If pretensioned strands are cut individually, they shall be cut in a manner to minimize lateral eccentricity of the prestressing force.
- All pretensioned prestressing strand shall be cut off flush with the end of the member and the exposed ends of the strand and a one inch strip of adjacent concrete shall be thoroughly cleaned and painted with one coat of zinc rich primer. Two coats shall be applied to strands, which will not be encased in concrete or mortar.

3.6.5 Grouting (Re: Sec. 50-1.09)

After post-tensioning, the post-tensioned tendon shall be pressure grouted. Grouting shall conform to the requirements listed in Section 50-1.09. Grout will be cement grout mixed at the ratio of one sack of cement with a maximum of 5 gal. of water. Consistency of grout must be measured in accordance with California Test Method 541. (Efflux time of grout shall not be less than 11 seconds). The grout pump shall have a pressure gage and the pump shall be capable of a pressure of 100 psi. Ducts shall be blown free of water and deleterious material prior to grouting. Grout shall be pumped until pure and clean grout, void of excessive air bubbles, exits the opposite end at a uniform rate.

3.6.6 Prestressing Precautions

The applied prestressing force, whether pretensioning or post-tensioning, will compress the concrete and cause members to both shorten and camber upward. Therefore, it is important that all formwork be removed and the members have the freedom to move longitudinally and arch upward. For pretensioned girders with deflected ("harped") strands, the deflected strands are first released prior to the application of the longitudinal prestress force. This upward force must be restrained either by the girder weight or mechanical means, or vertical cracking may occur at the hold-down locations. Because of the cambering effect, concentrated bearing loads will occur at the bottom edges at the girder ends. These concentrated loads may create serious breaking or spalling. Large triangular fillets forms at girder ends may prevent such damage and a greased sheet metal slide plate on the soffit will allow free movement which will help to reduce spalling due to girder movement.

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3.7 FORMWORK

3.7.1 General Requirements (Re: Sec. 51-1.05)

The final dimensions, including any built-in camber, are dependent on the accuracy of the concrete forms, whether wooden or steel. Current specifications are principally for wooden forms used in field construction. Most precast plants use steel forms of modular construction which can be modified easily for length and depth of section. There are no specific tolerances listed for final form dimensions. AASHTO provide acceptable guidelines for dimensional tolerances.

3.7.2 Inspection

The following are important form details to be verified by the QA Inspector:

- Dimensions shall accurately conform to member dimensions shown in the contract plans or as detailed on the approved working drawings.
- Forms shall be constructed to withstand the loads imposed by the hydrostatic and vibratory forces during placement of the concrete.
- All forms shall be clean with flat surfaces and joints shall be joined securely and be mortar tight. Concrete laitance and form oil build-up shall be removed.
- Forms for exposed surfaces shall be constructed with triangular fillets in order to produce smooth straight chamfered edges of the concrete member. Chamfers also help to seal joints in the forms and minimize leakage.
- All inside form surfaces shall be cleaned of all dirt, mortar, and other foreign materials prior to placing the concrete.
- A form oil ("bond breaker") shall be applied to form surfaces to allow their easy removal without injury to the concrete surfaces. Care must be used to prevent form oil from being deposited on prestressing and reinforcing steel.
- Holes are often put in steel forms for locating diaphragm dowels and for bolt-on end forms. Holes are also placed in the bottom form (soffit) to accommodate the hold-downs for deflected strands. Unused holes shall be securely sealed and the surfaces made flush.
- When external vibrators are attached to the forms, the details of such attachment shall be such to prevent form deformation and injury and be sufficiently rigid to transmit the required vibration to consolidate the concrete.
- Steam curing can deteriorate and weaken wooden forms. Wooden forms must be inspected and replaced whenever damaging deterioration occurs.
- Deck units are often designed with internal voids to reduce their weight. These voids are formed by the use of circular waterproof cardboard forms or polyurethane foam box sections. Such internal voids can develop considerable buoyant upward force while the concrete is in the fluid state. Positioning devices must be used to

resist these buoyant uplift forces to ensure the internal voids maintain their placed positions until the concrete has set.

- Both longitudinal and vertical movements will occur when the prestressing force is applied. Both the forms and cast members must accommodate these movements as damage can occur to both the forms and the cast members should such movement be extreme. The initial cambering of members can cause excessive bearing loads on the bottom end corners. If crushing or spalling occur at these edges, the forms and soffit must be redesigned to eliminate these effects of these damaging concentrated loads.

3.7.3 Dimensional Tolerances of Precast Members

The finished dimensions of precast members are dependent on the accuracy of the formwork and the prestressing forces transferred to the member. Typically, prestress members such as bridge girders and deck units are subject to design compressive prestressing forces that cause the members to camber and shorten. Inaccurate placement of the prestressing tendons may cause camber variations. These camber inconsistencies will create forming difficulties in the field for the cast in place decks. Prestressing tendons that are not centered laterally may cause permanent sweeps in the member. A small amount of lateral sweep may be corrected during field erection. The Inspector must carefully observe and check the camber of members for large variations which might result in field construction problems. Large camber variations cannot be corrected by adjustments in field erection.

Any dimensional tolerances for precast prestressed concrete members specified in a contract must be adhered to. In the absence of any specified tolerances, the AASHTO Tentative Standards for Prestressed Concrete Piles, Slabs, I-Beams and Box Bridge provides guidelines for acceptable dimensional tolerances. Most established precast plants are members of the Prestress Concrete Institute (PCI). PCI publishes dimensional tolerance guidelines. Most precast plants will accept these as acceptable inspection guidelines.

3.8 PLACEMENT OF REINFORCING AND PRESTRESSING STEEL

The QA Inspector shall confirm that all materials received at the precast plant have been properly tested and passed. The QA inspector shall confirm that the materials have been properly tagged and shipped with the required documentation.

Certificates of Compliance are required for all reinforcement steel bars (ASTM A615, Gr. 60 or A706 &A82 for spiral reinforcement). This is to assure Caltrans that the supplier is exercising satisfactory control over fabrication of reinforcing steel so that it meets the project specifications.

Reinforcing steel that is required to be tested should have been sampled at the source by METS and sent out for testing. When received at the plant, reinforcing steel bars must be accompanied with a Certificate of Compliance. If reinforcing steel bars are to be tested prier to arrival at the precast plant. When testing has been completed and has passed acceptance test then the load of reinforcing bars coming to the precast plant must have a green tag and Certificate of Compliance with each load. If epoxy coated reinforcement is specified, the epoxy coater must supply check samples to be tested. When testing of the epoxy has been completed and has passed acceptance test then the load of reinforcing bars coming to the precast plant must have a green tag and Certificate of Compliance with each load. Epoxy coating of reinforcing steel is further discussed in Section 2.2.9.

Reinforcing steel and post-tensioning steel bars should be checked for conformance upon arrival at precast plant. Check Certificate of Compliance for steel mill test reports, mill marking and test data checking against what was received at the plant. Certification of Compliance should match what was received at the precast plant.

Note: "Buy America" certification must also be provided for all steel materials when it is required.

Figures 3.1 through 3.4 have been provided to assist in the inspection of reinforcing steel.

Figure 3.1 Measuring the Diameter of Reinforcing Steel Bars

OVERALL REBAR DIAMETER

Bar Size	Approximate Diameter Outside Deformations, in. [mm]
#3 [#10]	7/16 [11]
#4 [#13]	9/16 [14]
#5 [#16]	11/16 [18]
#6 [#19]	7/8 [22]
#7 [#22]	1 [25]

Bar Size	Approximate Diameter Outside Deformations, in. [mm]
#8 [#25]	1-1/8 [28]
#9 [#29]	1-1/4 [32]
#10 [#32]	1-7/16 [36]
#11 [#36]	1-5/8 [40]
#14 [#43]	1-7/8 [48]
#18 [#57]	2-1/2 [63]

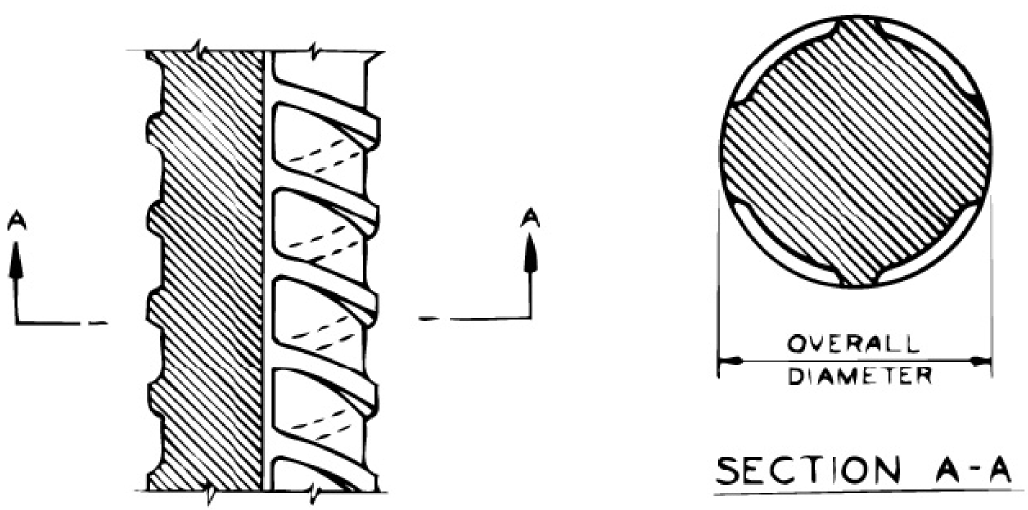


Figure 3.2 Dimensions of Metric Reinforcing Steel Bars

STANDARD METRIC REINFORCING BARS			
BAR SIZE DESIGNATION	NOMINAL DIMENSIONS		
	AREA (mm^2)	MASS (kg/m)	DIAMETER (mm)
#10	71	0.560	9.5
#13	129	0.994	12.7
#16	199	1.552	15.9
#19	284	2.235	19.1
#22	387	3.042	22.2
#25	510	3.973	25.4
#29	645	5.060	28.7
#32	819	6.404	32.3
#36	1006	7.907	35.8
#43	1452	11.38	43.0
#57	2581	20.24	57.3

Figure 3.3 Identification of Grade of Steel for Reinforcing Bars

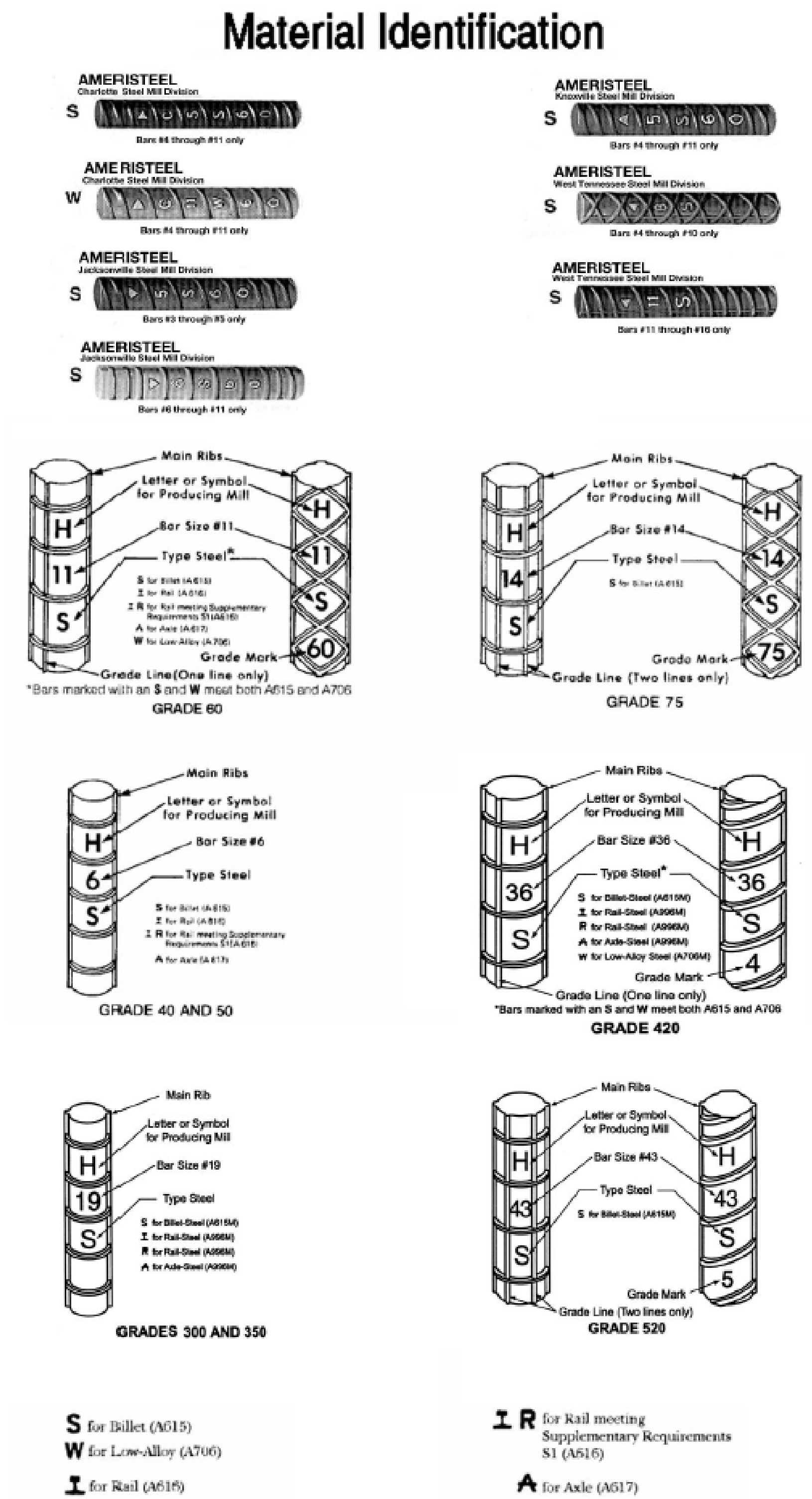
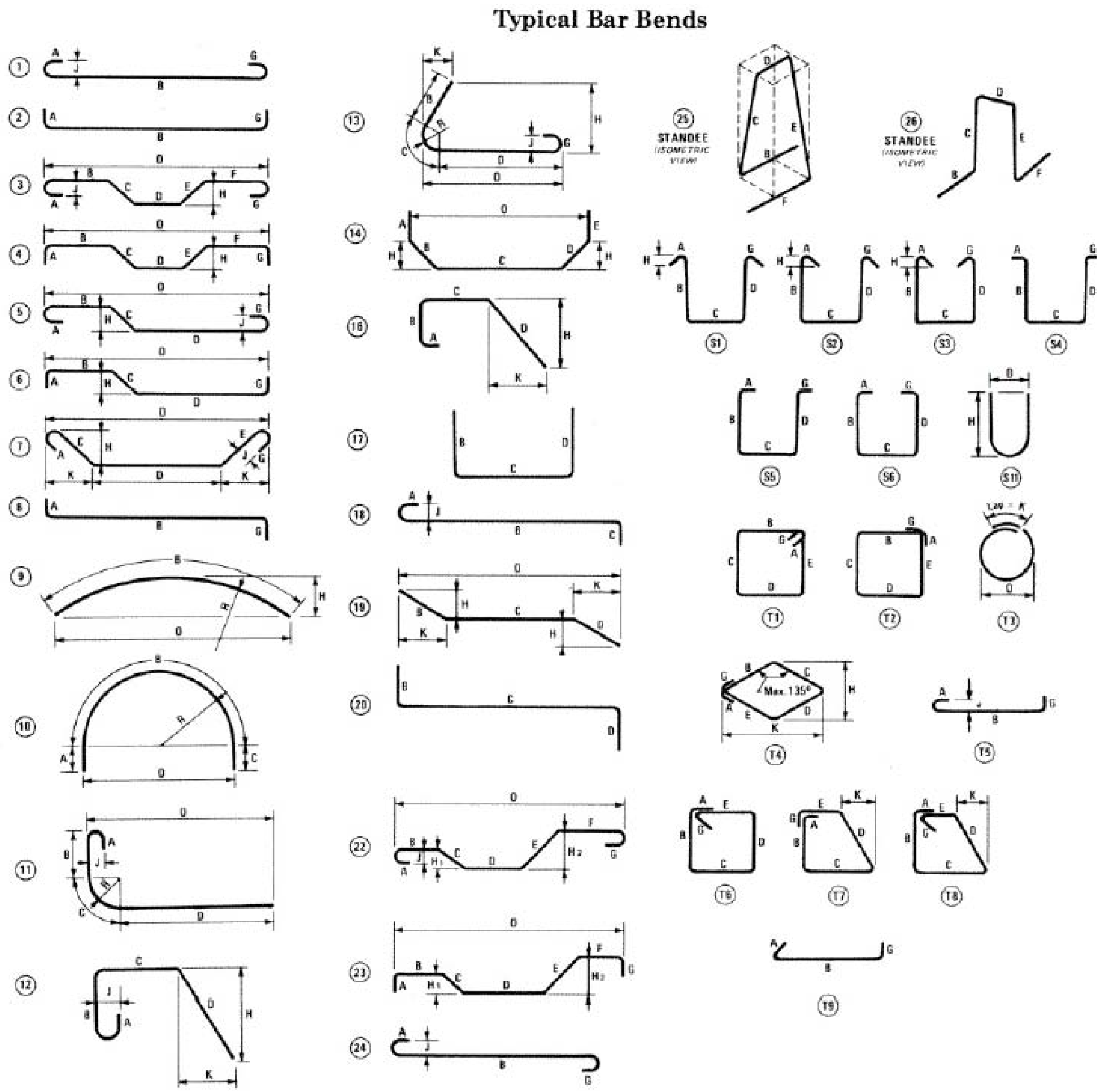


Figure 3.4 Typical Bend Configurations in Reinforcing Steel Bars



3.8.1 Placing Mild Steel Bar Reinforcement (Re: Sec. 52–1.07)

3.8.1.1 General Inspection Guidelines

- Bar reinforcement must be clean and free or dirt, oil, loose mill scale, excess rust or other deleterious material.

- Epoxy coated bar reinforcement must be clean and free deleterious material. If the coating is damaged the vendor must follow the manufacturer's repair procedures.

- Check Reinforcing bars shall be accurately placed as shown on the plans or approved working drawings. Check the reinforcement for grade. Current specifications require deformed bar reinforcement to conform to ASTM Designation: A 706/A 706M. Spiral reinforcement used in piles must be cold drawn wire complying with ASTM Designation: A 82. Reinforcement must be firmly and securely held in position by tie wire at intersections and lapped splices. "Tack" welding is not permitted. Reinforcing cages are often pre-tied in a jig. If the wire ties are not secure or there are an insufficient number of ties, the cages may shift from their original tied position. If this occurs, more ties must be used and the bars readjusted to their correct position in the forms. The protruding "pig-tails" formed at wire ties must be flattened to avoid impinging upon the forms. Epoxy-coated reinforcement must be tied with plastic-coated wire.

- Precast mortar bars - "dobies" - are customarily used for supporting rebar cages and maintaining their required clearance from the side forms. A sufficient number of these spacers ("chairs") must be used to provide positive support and maintain the specified clearance from the form surfaces. Metal, plastic, and wooden supports are not permitted. However, there are chairs made of alternative materials that may be acceptable. Check with your supervisor for their use in lieu of "dobies."

- Plastic hangers have been approved for use in the precast face panels of a per-approved alternative earth retaining system called the Reinforced Earth System (RES) supplied by the Reinforced Earth Company. The plastic hangers support the panel reinforcement and provide electrical isolation of the panel reinforcement from the tie strips used for connecting the soil reinforcement. The approved shop drawings should indicate the use of these plastic elements. Currently, the Reinforced Earth Company is the only vendor using approved plastic hangers. If another vendor proposes to use similar plastic hangers, consult with the Branch Senior before accepting or rejecting the precast panels.

- Rearranging the reinforcing steel is often necessary to accommodate the positioning of deflected pretension strands and embedded post-tensioning anchorages. Such changes are permissible when shown on the approved working drawings. If stirrups, are affected, check that the number of stirrups in a given length conforms to the contract plans..

- Lifting bales or threaded inserts are commonly tied to the reinforcing steel. This is acceptable if these embedded inserts on exposed surfaces are removed flush with the concrete surface after their use and covered with epoxy or mortar when the precast surfaces are not fully embedded in concrete and mortar after erection. For precast prestressed piles, embedded lifting inserts or other metallic devices must be positioned clear of all reinforcing and prestressing steel as required by the plans.

- Spiral reinforcement used for hoop reinforcement in piles must be accurately spaced as shown in the plans. Each unit of wire spiral reinforcement must be anchored at both ends and at splice locations by a 135-degree hook with a 6-inch tail hooked around an intersecting longitudinal prestressing strand.

- Precast vendors may add mild steel reinforcement to precast members to provide additional lateral stability during handling and loading. Such reinforcement is permissible when it is noted on the approved working drawings.

- Inspect splice bar reinforcement such as butt welds and mechanical couplers. Inspectors must witness the welding or coupling of bars. Representative sample should be taken in accordance with the Special Provisions. Send samples to the appropriate labs for testing.

- Butt welds, mechanical couplers and lap welds on epoxy coated bar reinforcing steel must be protected with an approved mastic-lined shrink tube protective cover.

- Check lapped splices for minimum lap lengths and stagger distances. Also, check that laps are securely tied.

3.8.2 Placing of Prestressing Steel Strand, and Bars (Re: Section 50)

3.8.2.1 General Inspecting Guidelines

- All prestressing steel shall be free of rust and any deleterious substances, particularly form oil which will be detrimental to the bond of the concrete. Prestressing steel shall be sampled and approved by the Laboratory prior to use. The “E” (modulus of elasticity) and “A” (actual steel area) shall be provided to the Contractor for final prestressing force and elongation calculations.

- The number, size, location, and prestressing force for prestressing steel shall be as shown on the contract plans or approved working drawings. Accurate location is essential to achieve the design requirements. Prestressing tendons not accurately located will create eccentric forces which will cause undesirable horizontal sweep and inconsistent camber in girder members. Mislocation of the steel C.G.S. (center of gravity of steel area) at the midpoint of members may create design deficiencies.

- Deflected ("harped") strands are held in position by steel hold-down devices. Considerable vertical force is placed on these devices. Most of these have built-in rollers to minimize friction. Hold-down devices should be designed to allow for longitudinal movement and be released gradually. If there is longitudinal tilting of these devices when the strand is tensioned, this would indicate that considerable frictional losses are occurring. Load cells can be used to determine the friction loss from the jacking end to the dead end of the bed. If there are high friction losses creating non-uniform prestress force within the member length, the hold-down devices need to be redesigned or the stressing sequence changed. Such occurrences should be reported to a supervisor.

- If members are post-tensioned rather then pretensioned, the location of ducts, anchorages, and grout tubes must be checked against the plans or approved working drawings. Both prestressing bars (ASTM A 722) and strands (ASTM A 416) are used for post-tensioning. Anchorage systems must be Caltrans approved. Ducts are usually placed in a parabolic path and held in place by wire tying to the reinforcing cage. Sufficient ties must be used to prevent dislodgment of the ducts during concrete placement. Ducts shall be securely taped at splices and where connected to the anchorage to prevent mortar leakage. Post-tensioning steel cannot be placed in the ducts until the conclusion of steam curing. Steel pipe is usually used to hold the ducts in their parabolic position and withdrawn after steam curing.

No tolerances are listed for placement of prestressing tendons. Acceptable guidelines are those listed in the AASHTO specifications.

3.9 CONCRETE MATERIALS AND TESTING

3.9.1 General Requirements (Re: Section 90 – Portland Cement Concrete)

The general requirements for the materials, manufacture, placing, curing and testing of concrete are contained in Section 90 of the Standard Specifications with the design compressive and prestress transfer strengths designated in the contract plans and in the Standard Plans for standard pile sections.

Maximum efficiency and profitability of the precast plant is dependent upon a daily turnover of their casting beds. Therefore, attainment of the transfer strength after overnight steam curing is the goal of the precast plant. This results often in 28-day strengths greater than the required 28-day strengths. The placing and curing (steam) methods of precast plants differ considerably from field placed concrete. Steel forms and external vibration allow lower slump and coarser mixes that are designed to achieve high early concrete strengths. Established precast plants are allowed to design their own concrete mixes, and trial batches are not required; however, the component concrete materials must meet the specified quality requirements.

3.9.2 Cement (Re: Sec. 90-2.01)

Type II modified cement is used for prestressed concrete. This cement has a finer grind that aids in achieving high early strength. All cement must additionally meet the specified low alkali requirements. Cement must be sampled for compliance testing and the cement mill is required to furnish a Certificate of Compliance. Cement content for prestressed concrete must be a minimum of 7 sacks and a maximum of 8-1/2 sacks per cubic yard. The water/cement ratios in the mix designs are kept low to attain higher earlier strengths. Admixtures and super plasticizers are incorporated in the concrete mix design to achieve greater workability. Cement content for “C” (corrosion resistant) piles are required to have a minimum cement content of 8 sacks per cubic yard. This is specified in the Standard Plans pile details.

3.9.3 Mixing Water (Re: Sec. 90-2.03)

Water used in prestressed concrete has more restrictive chemical requirements, principally lower chloride content that reduce the potential for corrosion on the prestressing steel. Water from public potable water supplies will normally conform to the chemical restrictions. Otherwise, samples of the water should be taken for testing to assure that the chemistry of the mixing water is within the specifications.

3.9.4 Concrete Admixtures (Re: Sec. 90-4)

Various admixtures are used to accelerate compressive strength, increase workability of the low slump concrete, reduce water/cement ratio, retard initial set, and provide air entrainment when required. Admixture requirements are specified in Section 90-4 Admixtures. All admixtures used must be on the Caltrans-approved list, and the permissible dosage must not be exceeded. "Super Plasticizers" are commonly used. These admixtures increase the fluidity of the mix and allow easier concrete placement without reducing compressive strengths. The increased fluidity of the mix makes a visual appraisal of concrete consistency (penetration) impossible. Because of the low water/cement ratios used, problems with excessive water content are unusual.

3.9.5 Aggregates (Re: Sec. 90-2.02)

Aggregates must conform to the quality requirements of the Standard Specifications or as superseded by the special provisions. Samples may be taken periodically to evaluate the cleanliness and quality of both fine and coarse aggregates. Most precast plants use a 1" maximum size aggregate for increased workability. For established precast concrete plants, the mix proportions of the concrete are determined by the plant. A trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures are not required (Re: Sec. 90-9). Most established precast plants have been using the same mix designs and materials for some length of time. Aggregates are usually obtained from local sources, who likewise supply Caltrans projects. Conformance of aggregates can usually be verified by the local District Labs. Concrete requiring increased freeze-thaw qualities will require a minimum air content. The QA Inspector shall determine the air content by tests performed to California Test Method 504. Freeze-thaw and air entrainment requirements will be listed in the contract special provisions.

3.9.6 Sampling and Testing Concrete (Re: Sec. 90-9)

3.9.6.1 Sampling (Re: Sec. 90-9.01)

Concrete test cylinders shall be fabricated from concrete sampled in accordance with California Test Method 530. Test cylinders are fabricated by the Plant QC personnel. Sufficient samples are taken for determination of the transfer and 28-day compressive strengths. These are initially cured within the steam curing enclosure until transfer strength has been reached. Test cylinders shall be cured in accordance with California Test Method 540. Precast plants are required to maintain test cylinders after transfer in a water bath between 60–80 deg. F for determination of 28-day compressive strength.

3.9.6.2 Amount of Water and "Kelly Ball" Penetration (Re: Sec. 90-6.06)

The amount of water used in concrete mixes shall be regulated so that consistency of the concrete as determined by California Test Method 533 is within the nominal penetration shown in the table of this section. Penetration measurements, due to the admixtures used by precast plants, are taken prior to the admixture additions. The amount of mixing water is seldom exceeded as it is important to maintain low water/cement ratios to obtain high early transfer strength.

3.9.6.3 Compressive Strength Tests (Re: Sec. 90-9.01)

Compressive strengths are required to meet both a transfer strength and 28-day strength. The transfer strength is the minimum compressive strength when the required prestressing force can be transferred to the member. The 28-day strength is the ultimate compressive strength required by the design. Generally, the transfer strength is lower than the 28-day strength; however, they may be the same. A compressive strength test shall consist of the average test results of two test cylinders. Test cylinders shall be tested in accordance with the requirements of California Test Method 521. Testing may be conducted at the precast plant's test laboratory for both transfer strength and 28-day strength in lieu of shipping to METS Laboratory, providing that qualified test technicians perform the tests and the test machines are properly calibrated. Concrete shall be considered acceptable when it achieves the required 28-day strength. Regardless of their compressive strength, <u>precast piles must not be released for driving until 14 days have elapsed since their original casting date.</u>

3.9.6.4 Other Concrete Tests

Concrete requiring increased freeze-thaw qualities will require aggregate sources listed on the METS approved list. Such concrete is specified to have a minimum air content. Air content shall be performed by QC personnel per California Test 504.

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3.10 CONCRETE MIXING AND PLACING

3.10.1 General Requirements (Re: Section 90-6 Mixing & Transporting)

Section 90-6 of the Standard Specifications list the requirements for mixing, transporting, and placing of concrete. The procedures of established precast plants differ from that for field placed concrete. Nonetheless, the QA Plant Inspector is responsible for enforcing the general requirements of the Standard Specifications.

3.10.2 Mixing and Transportation (Re: Sec. 90-6)

Precast plants either have their own concrete mixing machines or obtain their concrete from local ready mix plants. Mixers and mixing procedures must comply with the specifications. Truck mixers and agitator trucks used to transport and discharge concrete into forms must be checked for specification compliance.

Because of the high quality concrete required for prestressed concrete the local ready mix plants will generally be those that are established and supplying specification concrete to local Caltrans projects as well. Such plants will be monitored and certified by the local Caltrans District Lab. Verification of the ready mix plants' qualifications may generally be confirmed and documented by the local District Lab. The weighing scales and admixture measuring devices are generally certified by the local county weights and measures agencies.

3.10.3 Concrete Placing (Re : Sec. 51-1.09)

Concrete shall be placed and consolidated by the specified methods that will not cause segregation of the aggregates and will result in a dense homogeneous concrete which is free of voids (air and water) and rock pockets.

Modular steel forms are commonly used by precast plants. Low water-cement ratios are commonly used, which without the use of water-reducing admixtures or super-plasticizers, would be exceptionally stiff. Properly designed steel forms will allow heavy vibration energy to be used in the placement of the concrete. Both internal and external vibrators are generally used by precast plants. External vibrators must be securely attached to the steel forms and care must be used to not over-vibrate the concrete which could cause segregation and often excessive leakage at form joints. The thin web sections of I-girders through which the deflected prestress strand is located and the heavily reinforced end block areas are locations where extra vibration must be used to prevent rock pockets. Insufficient vibration will also result in excessive and large surface water and air voids on the 45-degree upper slope of the bottom girder flanges.

Form joints must be tight or mortar leakage will result. This leakage may cause weakened areas in the concrete section. Leakage at the bearing ends of girders is especially critical.

Bent and weakened steel joints must be straightened and repaired prior to their assembly. Heavy external vibration may cause the form joints to loosen.

When epoxy-coated bar reinforcement is used: internal concrete vibrators are required to have a resilient covering to prevent damage to the epoxy coating.

3.11 CONCRETE CURING

3.11.1 General Requirements

Concrete curing is performed by water, steam, or a combination of the two. Minor precast concrete products may use concrete curing compounds. Curing of concrete is specified in the Standard Specifications Section 90-7. The curing of precast concrete members and piles are covered separately. Except for the concrete curing compound method, all curing methods must utilize moist curing, where the surfaces are constantly moistened with water. The use of hot air blowers and radiant heated beds are not permitted.

3.11.2 Curing Precast Concrete Members (Re: Sec. 90-7.04)

Although water curing for not less than 7 days is permitted, the predominant curing method used by precast plants is steam curing. The higher curing temperature, 150 deg. F (65 deg. C) maximum, provides higher early strength. This permits attainment of the required prestress transfer strength overnight and results in greater efficiency and higher production.

The pre-steaming hold period and steam curing temperatures must be monitored for specification compliance. The temperature rise until the maximum curing temperature is attained shall not exceed 40 deg. F (22 deg. C) per hour. Specifications require recording thermometers to be used which will provide an accurate continuous permanent record of the steam curing cycle. A recorder is required for each 200 feet (60 m) of bed length.

Heavy tarpaulins or fabricated metal or wooden covers are used to contain the steam environment. These should be tight, provide good circulation, and not affected by heavy winds. Locations of steam outlets must be located to provide uniform distribution of steam and not impinge directly on the concrete, test cylinders, or forms. For long line beds where surface checking or cracking is noted prior to final covering and steam curing the concrete surfaces should be moistened intermittently to prevent such cracking.

Pretensioned members shall be de-tensioned immediately after steam curing while the concrete and forms are still warm or maintained above 60 deg. F (15 deg. C) until stress is transferred.

For other than "C" piles, curing of precast concrete will be considered complete after termination of the steam curing cycle.

3.11.3 Curing Precast Concrete Piles (Re: Sec. 90-7.05)

In addition to the standard steam curing requirements for precast concrete members, corrosion resistant piles, designation "C", are additionally required to be kept continuously wet for their full length for a period of 7 days, including the initial steam cure. Piles are generally stacked after removal from the casting beds and continuously moistened by the use of a sprinkler system. These sprinkling methods are adversely affected by winds, which can result in large surface areas unmoistened. The use of additional sprinklers or a moist blanket covering should be used, if this is a common problem. Water curing should also be extended for the period of time that the piles were not properly moistened.

3.12 REPAIRS AND SURFACE FINISHING

3.12.1 General Requirements (Re: Section 51.18 Surface Finishes)

General requirements for minor concrete repairs and surface finish are listed in Section 51-1.18.

Precast members that are steel-formed and steam-cured present some differences from concrete surfaces that are wooden-formed and water-cured in field construction.

3.12.2 Repairs

Small rock pockets and spalls on finished members, that are otherwise sound, may generally be repaired. Such defects must be removed to sound concrete with all edges squared and undercut to ensure that the patched area is securely keyed to the existing concrete. An approved epoxy adhesive may be used as a bonding agent. Steel inserts may also be used to provide a more positive anchorage for larger repairs.

The patching material should be a sand cement mortar that will achieve the same strength of the existing concrete. The patch should be water-cured or steam-cured. After curing, the patch should be closely examined for shrinkage cracks and sound bonding to the existing concrete.

Holes from form bolts and the hold-down bolts for deflected strands must be filled with mortar or dry pack. All patching mortar for exposed surfaces shall be mixed with white cement to achieve a close match to the steam-cured concrete which will be generally lighter in color.

Prestressed members which have cracks entirely through their cross section are not acceptable. If cracks are sound and tight, epoxy pressure grouting of the cracks may be used for repairs, subject to the Engineer's approval. The repair epoxy must be approved by the Laboratory.

Members should be inspected immediately after form removal. Large repairs in pretensioned members should be completed immediately and stress transferred after the repair has cured.

3.12.3 Surface Finish (Re : Sec. 51-1.18)

Section 51 - 1.18 of the Standard Specifications contains the requirements for the surface finishing of concrete structures. Ordinary surface finish, as defined, shall be applied to all concrete surfaces either as a final finish or preparatory to a higher class finish. A Class 1 Surface Finish is required for those surfaces which are readily exposed to public view. This would apply to the outside surfaces of exterior girders and the upper exposed surfaces of pile extensions used as columns. Class 1 Surface Finish shall consist of finishing the surfaces as necessary to produce smooth, even surfaces of uniform texture and appearance, free of unsightly bulges, depressions, and other imperfections. Grinding, patching, and "sacking" may be necessary to achieve the desired appearance. "Sacking," rubbing of surface voids with dry mortar, is used to fill air and water voids. Form lines and the lowered chamfered edges of members should be straight and uniform. Grinding will be necessary to grind off fins and any objectionable bulges. The degree of care in constructing tight and rigid forms will eliminate the need for most repairs and surface finishing. Good vibration will provide maximum consolidation of the concrete and prevent excessive voids from air and water entrapment. With good form work and proper vibration there should be a minimum of repairs and surface finishing.

3.13 STORAGE, HANDLING, AND SHIPPING

3.13.1 General

Precast prestressed concrete girders have little lateral stability and any undue lateral deflection due to handling, storage, and shipping may result in injury or the development of permanent horizontal curvature which may make the members unconstructable. The location of lifting and temporary support points, both in storage and shipping, must be carefully located.

Lifting devices cast in members must be located so that the bending moments created by the member's dead load do not create damaging stresses in the member when lifted. As a general rule, girder members should be supported or lifted at the same locations where the member will bear when they are finally erected. Support points for prestress piles in handling, storage, and shipping should balance their dead load moments so that the pile is not damaged. Piles are normally handled in the horizontal position when moved. Visual inspection should reveal a level appearance with no sagging evident between the support points when piles are moved.

Temporary supports for members in storage must maintain the member in an acceptable equilibrium that will not create excessive concrete tensile stresses. Concrete has little strength in tension. Girders must be maintained in a perfectly plumb condition. If they remain out of plumb for any length of time, excessive and permanent horizontal sweeps will develop. Supports must be placed on firm and well-drained ground so that they will remain level during wet weather. In performing inspections, Inspectors must maintain their distance from poorly supported girders as they may easily topple and result in serious injury.

Long I-Girders are usually braced laterally using a King Post Brace made of prestressing strands when being shipped. Numerous support points must be used to support piles when they are shipped. Cracks created during handling and shipping often go undetected as they are forced close by the prestressing force in the member.

Proper storage, handling, and shipping procedures are the responsibility of the Contractor. However, the Plant Inspector should closely examine the handling, storage, and loading of precast prestressed members for improper conditions that might create permanent damage. Such damage to members may create unnecessary construction delays.

Members which are permanently damaged as a result of cracking or permanent distortion are unacceptable. The manufacturer must be notified immediately of any rejections and the Inspector must notify his supervisor of such action. If the rejection will result in job delays, the Resident Engineer must be informed promptly.

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3.14 HAZARDS

3.14.1 General

It is the responsibility of the Inspector to have the proper safety equipment upon arriving at a precast plant. The Inspector should check in with the precast plant office and review the plants safety requirement and also to let plant know you will be working in their plant. The Inspector must wear a safety vest, safety glasses, safety toe shoes and safety hard hat. Earplugs should be worn in loud areas. Flotation vests should be worn when working over water. A lanyard is required when work 4’ to 6’ above the ground. An Inspector should have rubber and leather gloves, tape measure (standard and metric), stopwatch, dust mask and a calibrated concrete thermometer. Always follow plant safety rules. Stay alert and use common sense whenever working in dangerous and high traffic areas. Inspections shall not be performed whenever unsafe conditions exist. The contractor is to be notified that inspections will not resume until unsafe conditions are rectified.

Notify your Lead Inspector or Task Leader if additional safety attire and equipment is needed.

In general, the same hazards exist in the precast plants as in other plants that fabricate heavy bridge materials. Moving and lifting of heavy concrete members and component materials by overhead cranes and mobile lift equipment constantly present dangers of heavy falling objects. Inspectors must stay clear of any overhead objects when they are being moved and avoid walking next to stored heavy girders which are not on level and solid supports or are not properly braced in storage. Wearing of a hard hat is mandatory.

The prestressing operations present special dangers to Inspectors. The high tensile forces that must be put into prestressing tendons require the use of hydraulic jacking equipment under high pressure. Hydraulic pressure hoses and fittings can fail which will result in the spontaneous discharge of hydraulic oil under high pressure. Impingement of the oil, which may be toxic, and hose and fitting pieces could cause serious eye injury. Safety glasses or goggles must be worn for eye protection when monitoring gage pressure readings. Discharged oil should be immediately cleansed from the body to avoid toxic or allergenic reactions.

The most serious danger is the failure of the prestressing tendon or anchorages when they are being tensioned and deflected. The high energy in the stressed tendons can seriously or fatally injure a person if the tendons or associated anchorage components should fail them. Safety lights and horns are normally used to warn that stressing is being performed. Inspectors must be constantly alert to this ever-present danger in precast prestress plants.

Steam curing requires the use of steam boilers, hoses, and pipes for steam distribution. The pipes and hoses near the boiler will be constantly hot, upwards to 212 deg. F, with the temperatures at the steam enclosures upwards to 150 deg. F. The Inspector must be careful not to touch any parts of the steam distribution system or serious burns will be incurred. There is always the probably that pipe, hoses, and the boiler could burst. There is no need for the Inspector to risk injury by being near any of these components. The steam curing temperatures can be monitored by reviewing the time/temperature recording graphs which are required by the specifications.

The grouting of post-tensioned tendons also pose problems of bursting hoses and pipes when grouting is being performed. Cement grout discharging from failed components can result in injuries due to high grout pressures. Eye protection is especially important when inspecting the grouting operations.

Prestressing strand projecting from the ends of pretensioned members are removed by oxy-acetylene flame cutting or abrasive saw cutting. Hot and flying debris usually result from these cutting operations. The Inspector must protect his eyes and body when in the proximity of such cutting. However, there is generally no reason for the Inspector to be so near the cutting operation as to expose him/herself to injury.

3.15 PRECAST CONCRETE INSPECTION REPORTS AND RECORDS

3.15.1 General

To ensure that precast concrete products are fabricated in compliance with the contract plans and specifications, the QA Inspector files timely reports and keeps detailed records. Documentation of these essential tasks requires the completion of several forms.

3.15.2 Reports:

3.15.2.1 Form TL-6033, "Precast Concrete Inspection Report" and the "METS Precast Supplemental Concrete Checklist"

For each visit to a precast plant, the QA Inspector completes the "Precast Concrete Inspection Report" (TL-6033) and the "METS Precast Plant Supplemental Concrete Checklist" (Appendix H). The QA Inspector uses the report to summarize any significant observations and to document any pertinent conversations during the inspection. The mandatory supplemental checklist guides the QA Inspector through each phase of the precast fabrication process: pre-fabrication, pre-pour, pour, post-pour and final release. Only the applicable sections of the checklist need to be filled out for each visit to a precast plant. The QA Inspector submits the completed TL-6033 and checklist to the Quality Assurance Reviewer for review and approval. A copy of the report is sent to the Resident Engineer and the Inspecting Branch's Contract File. The report and the checklist are maintained in the Responsible Branch's Contract File

3.15.2.2 Form TL-6037, "Fabrication Progress Report"

The QA Inspector fills out the "fabrication Progress Report" (TL-6037) as fabrication of the precast products progresses and items are released to the jobsite.

3.15.2.3 Form TL-0029, "Report of Inspection of Material"

Upon final acceptance of the precast members, the QA Inspector affixes an "Inspection Release Tag" (TL-0624) to each load, or marks the lot number on each pile, released to the jobsite. The QA Inspector issues a "Report of Inspection of Material" (TL-0029) for each shipment.

3.15.3 Records

3.15.3.1 Project Specific Records

Form TL-6033 summarizes the information the QA Inspector needs to have before performing an inspection. As a minimum, the Department Precast Concrete Fabrication Qualification Audit should have been completed, and the shop drawings, concrete mix design and PCQCP should have been approved. All documentation that the contract specifications require for material to be released (including QC personnel, equipment calibration records and Certificates of Compliance for bar reinforcement and prestressing strands) should be located in the precast plant files, which are available to the QA Inspector upon request.

Project specific records are filed in the QASI branch where the project resides. Section 1.16 of this manual details the OSM uniform filing system

3.15.3.2 Audit Records

Approved audit records are kept on file in Sacramento and in each QASI branch. In addition, the OSM Internet and Intranet sites list precast manufacturers who have completed audits. See Section 1.14 of this manual for more details about audits.

3.16 DEFINITIONS

Abutment – A stationary anchorage system that is independent of bed or casting mold, used to withstand tensioning loads with various strand patterns. The structure against which the tendons are stressed and anchored.

Accuracy – The degree of conformity of a measured or calculated value.

Admixture – A material other than water, aggregates and cement used as an ingredient in concrete or grout to impart special characteristics.

Aggregate – Granular material, such as sand, gravel, crushed stone, and iron blast-furnace slag, used with a cementing medium to form a hydraulic-cement concrete or mortar.

Aggregate, Structural Lightweight – Aggregate with a dry, loose weight of 7- lbs. per cubic foot or less.

Ambient Temperature – The temperature of the air surrounding the form into which concrete is to be cast.

Anchorage – In post-tensioning, a device used to anchor tendon to concrete member; in pretensioning, a device used to anchor tendon to abutment during hardening of concrete.

Architectural Precast Concrete - Any precast concrete unit of special or occasionally standard shape that through application or finish, shape, color or texture contributes to the architectural form and finished effect of the structure; units may be structural or decorative, and may be conventionally reinforced or prestressed.

Back-Up Mix – The concrete mix cast into the mold after the face mix has been placed and consolidated.

Bleeding – A form of segregation in which some of the water in a mix rises to the surface of freshly placed concrete; also known as water gain.

Bond Breaker – A substance or material placed on to wrapped around a tendon to prevent it form bonding to concrete.

Bonded Tendon – Prestressing tendon that is bonded to concrete either directly or through end anchorage an grouting.

Bonding Agent – A substance used to increase the bond between an existing piece of concrete and a subsequent application or concrete, mortar, or grout.

Bugholes – Small holes on formed concrete surfaces formed by air or water bubbles.

Bundling – The practice of placing several parallel elements of reinforcement in contact with each other.

Calibration – The testing of a system by loading to determine accuracy as checked against a National Bureau of Standards certified load cell or proving ring.

Camber – The vertical deviation from the longitudinal product axis, which occurs in prestressed concrete members due to the net bending results from stressing forces, dead load, and/or live load. It specifically does not include dimensional inaccuracies due to errors in manufacture, improper bearings, or other deficiencies in construction. Positive camber is vertical deviation above the longitudinal axis and negative camber is below the axis.

Curing – The maintenance of humidity and temperature of freshly placed concrete during some definite period following placing, casting, or finishing to assure satisfactory hydration of the cementitious materials and proper hardening of the concrete.

Detensioning of Strand – The release of tension from the strand, usually occurring at the time the prestessing force is transferred form the bed anchorage to the individual pieces cast in the bed.

Detensioning Strength – The strength of the concrete cast on a particular line at the time the prestressing force is transferred.

Deviation – Variation from a specified dimension or design requirements.

Dimension – A geometric element in a design such as length or angle, or the magnitude of such a quantity.

Draft – The slope of concrete surface in relation to the direction in which the precast element is withdrawn from the mold; it is provided to facilitate stripping with a minimum of mold breakdown.

Dry-Mix Concrete – Concrete mixtures designed with very low water-cement ratios and slumps. Often referred to as zero slump concrete.

Dunnage – Materials used for keeping concrete elements from touching each other or other materials during storage and transportation.

Dynamometer – A device which will measure the tension applied to it when it is connected between two tensile forces.

Elongation – Extension of strand under given load based on its physical characteristics.

Gross Theoretical Elongation - The calculated elongation for a particular setup form chuck to chuck which includes all necessary corrections for operational losses (slippage, seating, thermal, etc.).

Net Theoretical Elongation - The calculated elongation for a particular setup form chuck to chuck after seating including appropriate corrections (slippage, thermal, etc.).

Face Mix – The concrete at the exposed face of a concrete unit used for specific appearance reasons.

Final Pressure – The prestressing force in the concrete after all substantial losses have occurred.

Form Release Agent – A substance applied to the forms for the purpose of preventing bond between the form and the concrete cast in it.

Gap-Graded Concrete – A mix with one or a range of normal aggregate sizes eliminated, and/or with a heavier concentration of certain aggregate sizes over and above standard gradation limits; it is used to obtain a specific exposed aggregate finish.

Hardware – A collective term applied to items used in connecting precast units or attaching or accommodating adjacent materials or equipment. Hardware is normally divided into three categories:

Contractor's Hardware – Items to be place on or in the structure in order to receive the precast concrete units, e.g., anchor bolts, angles, or plates with suitable anchors.

Plant Hardware – Items to be either embedded in the concrete units themselves, for connections and precast erector's work, or for other trades, such as mechanical, plumbing, glazing, miscellaneous iron, masonry, or roofing trades.

Erection Hardware – All loose hardware necessary for the installation of the precast concrete units.

Honeycomb – Stoney or void areas in concrete due to incomplete consolidations or paste leakage from form. May vary from small to large in size.

Initial Prestress – The prestressing force (stress) applied to the concrete at the time of detensioned or posts-tensioned concrete tendons are stressed and anchored.

Initial Strand Slippage – Slippage of strand into concrete at ends of products when bed is initially detensioned.

Jacking Force – A temporary force exerted by a device (i.e., jack or ram) that introduces tension into the strand or tendon.

Jaws – The parts of a strand chuck which actually contact or grip the strands.

Load Cell – Sensitive electrically operated strain gages attached to a calibrated cell to provide direct readings of compressive loads applied to the cell.

Loss of Prestress – The reduction of the prestressing force resulting from the combined effects of relaxation in the tendons. Creep and shrinkage in the concrete, and elastic deformation.

Low Relaxation Strand – Strand produced in accordance with ASTM A416 which has relaxation loss limited by its method of manufacture.

Lubricate – To coat with a substance for the purpose of decreasing friction.

Machine-Cast Products – Products cast by one or more machines specifically designed for the purpose for the purpose. Slipform and extrusion machines are types of equipment to make solid or hollowcore slabs.

Master Gage – A gage which has a minimum diameter of 8 in. and is calibrated every six months, used to check and/or monitor production gages.

Modulus of Elasticity – Ratio of normal stress to corresponding strain for tensile or compressive stresses with in the elastic limit of material.

Mold – The container or surface against which fresh concrete is cast to give it a desired shape.

Post-Tensioning – A method of prestressing concrete whereby the tendon is kept form bonding to the plastic (wet) concrete, then elongated and anchored directly against the hardened concrete, imparting stresses through end bearing.

Pretensioning – A method of prestressing concrete whereby the tendons are elongated, anchored while the concrete in the member is cast, and released when the concrete is strong enough to receive the forces from the tendon through bond.

Proving Ring – An elastic alloy steel ring used to calibrate or measure loads. A dial indicator inside the ring measures deflection under load and calibration curves enable direct determination of the load. Standard high capacity rings, certified by the National Bureau of Standards and accurate to 0.1 or 1% are used to calibrate mechanical force measuring systems.

Relaxation – The loss of stress in a prestressed steel strand which occurs over time while the strand is under stress due to the realignment of the steel properties.

Re-Tempering – The addition of water and re-mixing of concrete which has started to stiffen in order to make it more workable.

Segregation – The tendency for the coarse particles to separate from the finer particles in handling; in concrete, the coarse aggregate and drier material remains behind and the mortar and wetter material flows ahead; this also occurs in a vertical direction when wet concrete is over-vibrated or dropped vertically into the forms, the mortar and wetter material rising to the top; in aggregate, the coarse particles roll to the outside edges of the stockpile.

Self-Stressing Form – A form which carries the load from pretensioned strand through end plates or bulkheads attached directly to the form. The form (bed) may shorten during tensioning and subsequent anchoring of strand against the ends; magnitude of shortening depends on cross-sectional area of form, number of and prestress force on strands, and form length and stiffness.

Strand – A tendon usually composed of three or seven-wire assemblies used as reinforcement in prestressed concrete.

Strand Chuck – A device for holding a strand under tension generally comprised of a barrel, grooved jaws, with and "o" ring pulling them together and a spring-equipped cap.

Strand Seating – The amount of movement by a tensioned strand into an anchorage chuck and its jaws as it is released from a tensioning ram and seated into the chuck or at the dead end of the bed as strand seats into chuck under loading from initial to final tension.

Strand Slippage – Slippage of strand into end of a product due to loss of bond with concrete.

Strand Splice – A mechanical method of connecting two lengths of strand together that will sustain the breaking strength of the strand.

Superplasticizer – A high range water reducing admixture producing concrete of significantly higher slump without addition of water or reducing water with no change in slump.

Tendon – A tensioned element, generally high-strength steel wires, strands, or bars, used to impart prestress to the concrete. In post-tensioned concrete, the complete assembly of prestressing steel, anchorage's and sheathing when required is also called a tendon.

Tolerance – Specified permissible variation from stated requirements such as dimensions, strength, and air entrainment.

Wet-Mix Concrete – Concrete mixtures designed for typical water-cement ratios, slumps and handling and consolidation methods.

Workability – The ease with which a given set of materials can be mixed into concrete and subsequently handled, transported, placed, and finished with a minimum loss of homogeneity.

Section 4. Structural Steel/Welded Steel Products

4.1 GENERAL SCOPE AND PROCEDURES

This section covers the inspection of fabricated steel products which generally require the highest level of Quality Assurance Inspection (QAI). Shop fabrication and field inspection of welded steel bridge members will be conducted by Materials Engineering and Testing Services (METS), Office of Structural Materials' AWS Certified Welding Inspectors (CWI) with the most experience and proficiency in the inspection of steel fabrication techniques, welding procedures, nondestructive testing, interpretation of shop working drawings, and ability to maintain concise and accurate inspection records. The following welded steel products are those for which the highest level of QAI will be required, both in the shop and field:

- STRUCTURAL STEEL BRIDGE (Fracture Critical Members)
- STRUCTURAL STEEL BRIDGE
- BRIDGE STRENGTHENING MEMBERS (Seismic Retrofit and Restrainers)
- SPLICING OF BAR REINFORCEMENT

4.1.1 Scope

All phases of the inspection of welded steel products are covered in this Part 4. This includes general guidelines to be followed in the QAI of fabricated structural steel and other welded steel materials. Variations in the design and contract specifications will require the Inspector to use judgment in implementing the instructions in this section. <u>It is emphasized that these instructions may on some occasions conflict with the contract specifications, and the Inspector is reminded that the contract specifications always take precedent over these inspection guidelines whenever there is a conflict.</u> Within the context of this Part 4, "Inspector" shall mean the METS person responsible for providing QAI for the California Department of Transportation.

4.1.1.1 Organization

Part 4 has been written to provide guidance for the Inspector in the following:

1. General instructions, responsibilities, and governing specifications
2. Preparation for performing required QAI tasks
3. Prefabrication and Pre-Welding meetings with the Contractor (Fabricator)
4. Contractor's Welding Quality Control Plan (WQCP)
5. Inspection, sampling, and testing of steel materials
6. Qualification of welding procedures (WPS/PQR), welders, and welding operators
7. Fabrication requirements

8. Nondestructive testing
9. Application of protective coatings (surface preparation and painting)
10. Repairs and non-conformance reports
11. Inspection documentation, acceptance procedures, and reports of inspection

4.1.2 General Instructions and Responsibilities

All materials shall be inspected to ensure substantial compliance with the contract special provisions and plans. In general, the reference specifications will be the California Standard Specifications, AASHTO and AREA Specifications for materials and fabrication workmanship. The Contractor's Quality Control Inspection (QCI) is governed by the special provisions, Section 8-3. **Welding**. Welding will be governed either by AWS D1.5 Bridge Welding Code, AWS D1.1 Structural Welding Code, AWS D1.4 Structural Welding Code for Reinforcing Steel, and the provisions of Welding Quality Control. For the fabrication of Fracture Critical Bridge Members either the AWS/AASHTO or AREA Fracture Control Plans will govern areas of materials, workmanship, and welding. The assigned shop inspector must be familiar with each of these specifications.

QAI shall verify that fabricated and welded members substantially conform to the approved shop working drawings. Therefore, the inspector must be capable of interpreting details of shop working drawings, particularly welding symbols, and knowledgeable of the commonly used shop fabrication techniques and terminology. Nondestructive testing (NDT) may be required of all critical weld joints. NDT requirements will be specified in the applicable AWS Code, contract documents, and Welding Quality Control Section of the Special Provision. The Inspector must have adequate training and experience as spelled out in the Written Practice for the Office of Structural Materials in order to monitor and conduct NDT in a periodic and systematic manner and to ensure that NDT is performed and interpreted in accordance with contract requirements. QAI requires witnessing and evaluating physical tests of base metals and weld test plates. The Inspector must be knowledgeable of physical test procedures and be able to perform the mathematics to verify test results. Concise diaries and accurate inspection records must be maintained in a timely manner in accordance with the instructions in the this Section and Section I of this Manual. In the performance of QAI, the Inspector must work towards maintaining a cooperative relationship with the Contractor and Fabricator and perform QAI on a timely basis so as to not create contract delay claims by the Contractor. Close and timely communications must be maintained with the Inspector's Supervisor so that all inspection problems will be reported and quickly resolved.

To meet these objectives, the Office of Structural Materials of Materials Engineering and Testing Services (METS) will normally assign qualified Assistant or Associate Steel Inspectors to perform shop fabrication and field welding inspections. All Inspectors assigned to perform welding inspections on structural steel bridges shall be AWS Certified Inspectors (CWI). The Associate Steel Inspector may act as lead person over Assistant Steel Inspectors. The overall administration and direct supervision of the QAI function is the responsibility of the METS Supervisor for the Branch to which QAI is assigned.

4.1.2.1 Duties of the Inspector

1. **Specification Review**: At the beginning of each inspection assignment, the Inspector and supervisors shall obtain and thoroughly review all specification documents. This will include the contract special provisions, including any requirements for Welding Quality Control, contract plans, Standard Specifications, and any applicable codes such as AWS, AASHTO, AREA, ASTM, SSPC, etc. The contract plans must be thoroughly reviewed and any discrepancies and questions referred to the Engineer. Shop working drawings, including the Fabricator's Quality Control Plan (QCP) should be transmitted to the Inspector in advance of fabrication. Delays in their transmittal should be referred to the Engineer. Significant discrepancies in the shop working drawings with the contract plans should also be brought to the attention of the Resident Engineer. The following table lists most of the applicable specifications:

Fabricated Item	Standard Specification	Ref. Standard Spec.	Required NDT and Ref. Standard Spec.	Specification References
Structural Steel Bridge Members & Attachments	Sec. 55	AWS D1.5, Sec.8-3 Weld QC Sec. 55-3.17	RT, UT, MT AWS D1.5, Sec.6.7 Sec.55-3.17	Fracture Critical Members AWS/AASHTO Fracture Control Plan
Column Casings & Bridge Strengthening Steel	Sec. 55	AWS D1.5	None – Check Spec. Provisions	Re : Sec.8-3 of Spec. Prov. Welding Quality Control
Shear Connectors (Studs)	Sec. 55	AWS D1.5 Sec. 7	None	
Misc. Steel , Br. Metal, & Restrainers	Sec. 75	AWS D1.1	None	Re : Sec.8-3 Spec.Prov. Welding Quality Control
Steel H & Pipe Piles	Sec. 49-5.02	AWS D1.1	MT & UT for Tension Piles	Re : Sec. 8-3 Spec.Prov. Welding Quality Control
Sign Structures	Sec.56-1.04	AWS D1.1	Check Spec.Provisions	" " "
Field Welding CJP Welds Def. Bars, Spirals & Hoops	Sec.52-1.08B	AWS D1.4	RT – 25% of Joints Sec. 52-1.08F	" " "
Shop Welding, CJP & ERW Column Reinforcement	Sec.52-1.08	AWS D1.4 & Spec. Provisions	None Required for Shop Welds	" " "
Bridge Railings	Sec. 83-1.02	AWS D1.1	None	
Signal and Lighting	Sec. 86-2.04	AWS D1.1 and Spec Provisions	None	" " "
Note : For welding performed by an AISC Certified Category III (Major Bridges) Fabricator the Special Provisions Sec.8-3 Welding Quality Control may not apply in its entirety..				

Table 4-1. Applicable Welding Specifications.

2. **Materials**: Obtain and review mill orders, mill test reports, and certificates of compliance. Check materials for compliance with the physical and chemical test requirements of the specified steel specifications. The required steel specifications will be designated on the contract plans or referenced to Section 55-2 Materials of the Standard Specifications. Structural steel for bridges is generally specified to comply with ASTM Designation A 709, Grades 36 or 50, and supplemental toughness values for Fracture Critical Members (FCMs) and tension members,

eyebars, and hanger plates. Equivalent ASTM steels meeting the specified A 709 specifications may be permitted. When toughness is specified, verify that Charpy V-Notch tests have been performed and comply with the specified impact values. Verify heat numbers agree with mill test reports, mill markings are as specified, inspect for obvious surface defects, select and witness the cutting of all designated check test samples, and obtain domestic certifications when contract is governed by the "BUY AMERICA" ACT.

3. **Welding:** QAI of welding is the most demanding task for the Inspector. This is due to the complexity of the AWS D1.5 Bridge Welding Code combined with the supplemental requirements of the new Weld Quality Control special provisions. The complexity becomes even greater when Fracture Critical Members (FCMs) are fabricated and must meet the more stringent welding requirements of the AWS/AASHTO Fracture Control Plan (FCP). The Inspector must first closely review the specific contract requirements and plans to determine what welding code and specifications apply to the contract being inspected. Similarly, the NDT requirements for welds, which are supplemented by the Weld Quality Control special provisions, must be researched.

   The following are principal welding codes and supplemental requirements:

   - Section 8-3. **Welding**:
     http://www.dot.ca.gov/hq/esc/oe/specifications/SSP%27s/99-SSPs/Sec_08_Mtls/08-3_Welding/
   - AWS D1.5 Bridge Welding Code
   - AWS/AASHTO Fracture Control Plan (Re: Section 12 of AWS D1.5)
   - AREA (American Railway Engineering Association) Railroad Bridges
   - AASHTO D1.1 Structural Welding Code
   - AWS D1.4 Structural Welding Code for Reinforcing Steel

   The applicable AWS Welding Codes require the submittal of a welding procedure specification (WPS) which provide the weld joint details and all of the essential variables that control the welding process. For welding governed by AWS D1.5 and a FCP, the WPS must be qualified by testing. A procedure qualification test must be conducted by the Contractor to qualify WPSs to be used. The test results that qualify a WPS are reported on a procedure qualification record (PQR). The Inspector's first task is to review the WPS/PQR submittals to verify compliance with the specific contract requirements. For welding governed by AWS D1.1 Structural Welding Code, the WPS is considered prequalified when standard welding joints and approved weld filler metals are used. The SMAW "stick" process is generally prequalified by both AWS Codes, and PQRs are not required.

   Prior to any welding, the welders and welding operators' qualifications must be determined. Qualifications must be in conformance with the applicable welding code and the special provisions supplemental requirements listed in Welding Quality Control. Qualifications must be within the allowed period of effectiveness.

All welding equipment and weld filler metals must be evaluated for contract compliance. Storage containers for welding electrodes and fluxes must be inspected to verify that both drying and storage temperatures comply with specifications.

QAI of welding shall include verifying that welding is being performed in accordance with the approved WPS. This will require monitoring the weld joint details, the weld process and filler metals being used, preheat and interpass temperatures, welding technique, weld profiles, final weld finish, etc.

For welds that are subjected to nondestructive tests (NDT), the Inspector shall verify that the frequency, number, and location of NDT is as required by the governing specifications. The specified NDT process (RT, UT, MT, DPT, VT) and technique being employed must be verified for compliance with the approved written practice and be performed by a Level II Technician. The written practice will be contained in the Contractor's Welding Quality Control Plan (WQCP), as required by the Welding Quality Control special provisions.

Weld deficiencies shall be reported in a non-conformance report and the Inspector's Supervisor shall be notified of any deficiencies requiring critical weld repairs. The Contractor's repair procedures for critical weld defects shall be reviewed and approved. Repaired welds shall be evaluated by visual inspection and NDT retests.

An important role of the Inspector is monitoring the Contractor's Quality Plan. Failure of the Contractor to follow the WQCP should be treated as a non-conformance report (NCR) in accordance with Section 1.8 of this Manual.

4. **Fabrication**: Fabrication requirements are listed in Section 55-3 Fabrication of the Standard Specifications. QAI shall be performed to ensure substantial compliance of cutting (shearing and flame cutting) and assembly of material; maintain heat number traceability of main members (flanges and webs); inspect punching and drilling of holes and shop bolted joints; verify shop assembly of field splices and match-marking of bolted joint components; inspect grinding and cleanup of cut edges; verify that welded girders are within dimensional tolerances (web flatness, flange tilt, etc.) of the AWS Code; and monitor all heat straightening; and check fit-up of stiffeners and bearing plate flatness. Ensure that the Fabricator's QC Inspector is performing these same tasks in accordance with the Fabricator's Quality Control Plan.

5. **Protective Coatings**: Blast cleaning and paint application requirements are listed in Section 59-2 Painting Structural Steel. Monitor the blast cleaning and painting of structural steel for compliance with these specifications or as superseded by the special provisions. This will include sampling of paints; verify acceptability of blast

cleaning and painting equipment; ensuring blast profile is as specified; measuring temperature, relative humidity, and dew point for specification compliance; measuring dry film thickness of paint applications for required thickness, and verifying that the prime coat achieves the required adhesion strength. For high-strength bolted joints the contact (faying) surfaces are limited to a maximum primer thickness to ensure that the required joint friction is obtained. Check special provisions for the specified coating thicknesses. Environmental restrictions require water based paint systems. Water based paints must be applied within the specified temperature and relative humidity range or the system will perform poorly. Zinc primers must be thoroughly cured before finish coating. The use of finish coats over zinc primers is now being discouraged. If finish coats are specified, the primer and finish coat paints must be furnished by the same manufacturer. Verify that the Contractor is conducting required quality controls for all of the paint operations. The Contractor must maintain written inspection records. The Inspector must also document his inspection activities. Additional information can be found in Section 4.5 of this Manual

6. **Final Inspection**: A final evaluation of the materials and fabrication workmanship shall be made by the Inspector. The Inspector shall ensure that the Fabricator has conducted his own Q.C. function and provides the required Certificate of Compliance for the materials and workmanship used to fabricate the product. Based on the Inspector's periodic and systematic inspections of workmanship and satisfactory tests of required check samples, Inspection Release Tags may be put on material shipments judged to be in substantial compliance with the contract documents and a Report of Inspection (Form TL-0029) issued to the Resident Engineer.

7. **Documentation**: The directions given in Section 1 of the OSMPP shall be followed. Inspectors shall utilize the Welding Inspection Checklist located in Appendix J when performing inspections of steel products. This includes but is not limited to “OK to cuts”, material identifications, sign structures, signal and lighting poles, welding, miscellaneous metal, in-process inspections, nondestructive testing, and final material releases. The checklist is not required for friction welded or electric resistance welded rebar. QAI requires that inspection reports be maintained by the Inspector that will describe the daily fabrication details, including all significant problems encountered and all pertinent conversations with the fabricator's personnel and other Department personnel. Weekly Fabrication Progress Reports must be submitted and monthly verification of materials on hand reports are to be issued to the Resident Engineer when requested. The Inspector must maintain a shop file that will contain all the documents and reports to verify that inspections and tests have been performed and other documents and correspondence pertinent to the project. See Appendix C – Inspection Forms. File documents will include, but are not necessarily limited to, copies of all mill orders, mill test reports, welders and operators certifications, weld procedure submittals and test reports, weekly progress reports, daily diaries, all correspondence relevant to job, nondestructive test records,

non-conformance and repair reports, paint inspection records, certificates of compliance, and reports of inspection. Copies of contract special provisions, contract plans, approved shop working drawings, approved welding procedure specifications, welders and welding operators approved qualifications, and the Contractor's Quality Control Plan shall always be available in the Inspector's shop files for immediate reference.

8. **Final Loading and Storage**: Check each shipment of fabricated members. Members weighing more than three tons shall have the weight marked thereon. Do not allow any welding of brackets, clips, or tie-down rods to fabricated members. Such devices may be requested to facilitate shipping and handling. Any attachments to fabricated steel members not shown on the contract plans must be approved in writing by the Engineer. Holes are often permitted in bridge girder members to help support the concrete deck forms. These holes will be often shown on the shop working drawings. Members should be supported so that deflections or induced stresses during storage, transportation, and handling do not cause permanent damage. When in doubt, require the Fabricator to have loading procedures approved by the Engineer as allowed by the contract documents. If fabricated members are subjected to long-term storage, they shall be properly stored and protected from damage during storage from the elements.

4.1.2.2 Prefabrication/Pre-Welding Meeting

Special Provision Section 8-3. **Welding** requires that a pre-welding meeting be conducted prior to the start of fabrication and welding. Preliminary to the meeting with the Contractor or Fabricator a meeting with only the Engineer is held to thoroughly review specifications and plans so as to clarify any interpretation differences, define areas of responsibilities of the METS Inspector and Engineer, establish lines of communication, and the distribution of contract documents, correspondence, inspection reports, etc.

A second prefabrication/pre-welding meeting will be scheduled with the Contractor or Fabricator. An important step in getting the QC/QA inspection process properly underway is the prefabrication/pre-welding meeting. QC is the responsibility of the Contractor and the written submittal of a Quality Control Plan (OCP) is mandatory. Quality Assurance (QA) is the prerogative of the Department. Inspection personnel and the key personnel of the Fabricator shall have both reviewed the specifications and plans in advance so that any questions or differences in interpretation can be resolved before the ordering of material and fabrication gets underway. A mutual understanding at this time of the roles of the Inspector and Fabricator can help to establish cooperative relations through the course of the job and head off problems. The following subjects provide a format for a meaningful prefabrication conference:

1. Review of applicable specifications and plans.
2. Submittal and review process for shop working drawings.
3. Documents to be supplied by Fabricator:
   a. Mill orders and purchase orders for steel materials.

b. Certified mill test reports and certificates of compliance. Domestic certifications when "Buy America" Act applies.
c. Fabricator's Quality Control (Q.C.) program, including qualifications of QC/NDT personnel and details of NDT. Refer to Sec. 8-3 of Special Provisions for QCP requirements.
d. Fabricator's AISC Certification and Category, if required.
e. Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR).
f. Welder/welding operator certification tests. Verify period of effectiveness.
g. Certified Test Reports for all welding consumables.
h. Copies of all nondestructive test reports and radiographic film.
i. Copies of shipping list for material shipments, listing quantities, piece numbers, and approximate weights.
j. Fabricator's Certificate of Compliance.

4. Check sampling and testing of steel when specified. Anchor bolts, structural fasteners, paint, elastomeric bearing pads, etc., should be "Green Tagged" at source whenever practical.

5. General fabrication requirements (cutting, punching, drilling, fit-ups, shop assembly, bolting, dimensional tolerances, etc.).

6. Welding requirements (qualification of welders/operators, weld procedure tests, workmanship, nondestructive test, etc.).

7. Details of surface cleaning and painting for any shop applied protective coatings, including Q.C. Plan and AISC Certified Paint Endorsement or SSPC (Steel Structures Painting Council) Certification.

8. Fabricator's proposed fabrication and shipping schedule. The need of additional inspectors or overtime may be predicted by off-hour shifts or weekend work.

9. For bridges with Fracture Critical Members (FCM), the Fracture Control Plan (FCP) should be closely reviewed and the extra requirements pointed out.

<u>The SMR must document the names of attendees and the proceedings of the prefabrication conference.</u>

4.2 MATERIALS SAMPLING AND TESTING

4.2.1 Steel Plates, Shapes, Bars

Generally, steel to be used in the fabrication of welded plate girders and rolled steel shapes may be accepted on the basis of certified mill test reports, provided the heat numbers, original mill markings, and visual quality as required by ASTM A 6 or A 20, can be readily verified. The Inspector is responsible for reviewing mill test reports for compliance with the required physical and chemical test requirement. The required specifications for the steel may be found in the contract special provisions or contract plans or Section 55-2 Materials of the Standard Specifications when steel specifications are not listed on the plans. Unless otherwise specified in the contract special provisions or plans, all structural steel plates, shapes, and bars shall conform to ASTM Designation A 709, Grade 36 or ASTM A 36. Structural steel used in the fabrication of tension components and Fracture Critical Members (FCMs) is required to meet minimum Charpy V-notch (CVN) Impact Values. Be sure that these values as shown on the mill test reports meet the minimums specified for the contract. The required impact values can be found in Sec. 55 of the Standard Specifications and for FCMs will be in the governing Fracture Control Plan for the contract.

Copies of mill orders are required to be supplied by the Fabricator. These should be checked to see that the correct specification steel was ordered. Dimensions of steel plate ordered must be such that the primary direction of rolling is parallel to the direction of the main tensile stress or main compressive stress in the member. If the steel has been correctly ordered and certified mill test reports correlate, these provide reasonable assurance that the steel received meets specifications.

Sec. 55 allows the Fabricator to use a small amount of unidentified stock steel unless the "Buy America" Act applies to the contract. Acceptability is subject to random samples, tested at the Fabricator's expense and meeting contract specifications.

4.2.2 Check Test Samples - Plate Girders

Bridge contracts with FCMs require check test samples to be taken from specific locations in the girder members that will be designated in the contract plans. The Inspector shall witness the cutting of these samples and properly identify the samples, including rolling direction. The requirements for these samples are contained in the special provisions. Sampling may be conducted at the mill, if so requested by the Fabricator; however, the extra costs of traveling to the mill will be charged to the Fabricator. Samples are to be shipped to the Structural Materials Testing Branch of the Office of Structural Materials in Sacramento for testing. Note that the requirements for the check tests provide a tolerance for the minimum and maximum test values, usually five percent, as compared to the actual steel specification. Test results should be reported within ten days after receipt of samples by the Structural Materials Testing Branch.

4.2.3 Fasteners, Fastener Components, and Anchor Bolts

Fasteners, fastener components, and anchor bolt assemblies must be inspected, sampled and tested for compliance to appropriate specifications. A complete set of legible, certified test reports from the manufacturer (as listed in the appropriate ASTM Specification) must be furnished by the contractor for all fasteners and fastener components, including bolts, nuts, washers, tension control (TC) fastener assemblies, cap screws, and direct tension indicators. Components of ASTM A 325 and F 1852 high-strength fastener assemblies must be identified and supplied by Rotational Capacity (RoCap) lots. Verify that zinc-coated nuts are lubricated as specified in ASTM A 563. Certified RoCap test reports must be furnished for each shipment. Special procedures for performing RoCap testing on ASTM F 1852 and A 325 high-strength fastener assemblies may be included in contract specials, and must be followed by both the Contractor at the job site, and the manufacturer. Take required samples of fasteners and fastener components according to the sampling chart in Section 2.4.9, and forward these, along with a complete set of legible test reports to the Structural Materials Testing Branch for evaluation and testing. Random samples of all components of fastener assemblies (bolt, nut, washer, and direct tension indicator washer, if furnished) must be taken from the same lots of bolts, nuts, and washers, etc. that will be used on the job. Inspectors or Engineer's representatives taking samples shall verify that: 1) fasteners are properly packaged, 2) all information required by ASTM to be on fastener packages is complete and present, 3) fastener components being sampled are the proper length and size, and are marked in accordance with the applicable specification, 4) the Contractor has furnished a complete set of test reports for each component being sampled, as listed in each applicable ASTM specification, 5) all test reports are legible, and 6) sizes and grades of fastener components shown on each test report correspond to those components actually being sampled. Fasteners not complying with the above requirements shall be rejected.

Mild steel anchor bolts must conform to requirements for the appropriate grade in either ASTM Designation: A 307 or AASHTO Specification: M 314, Gr. 36 or 50, including the S1 supplemental requirements to ensure weldability. All bolts, nuts, washers, tension control (TC) fastener assemblies and direct tension indicators (DTIs) must have all required markings on each piece, as required by the appropriate ASTM specification (usually the manufacturer's name or logo and grade markings). Overtap clearances on zinc-coated nuts and the presence of dyed dry lubricant must also be verified. Zinc coating of high-strength fasteners may be by the hot-dip galvanizing process (ASTM A 153) or the mechanical deposition method (ASTM B 695). When zinc coating of TC fastener assemblies and DTIs is required, it must be done by the mechanical deposition method. Hot-dip galvanized nut blanks must be tapped after galvanizing. Nuts that are zinc coated by the mechanical deposition process may be tapped either before or after zinc coating, and may have zinc on the flanks of the nut threads.

High-strength anchor bolts and rods are generally designated as ASTM Designation: A 449, Type 1. They are produced by heat treating (quench and temper) a medium carbon steel. Cold drawn rod stock having equivalent mechanical properties is not acceptable for A 449 fasteners. No welding is allowed on high-strength anchor bolts or related heat-treated components.

4.2.4 Protective Coatings (Paints)

All shop-applied paints must be sampled and tested for compliance prior to their application. Whenever possible, the paints should be sampled, tested, and released at the point of manufacture. For some of the very heavily pigmented paints, such as zinc primers, and 2-component paints, it is best to sample a complete five-gallon container or the as received smallest unit sample from the factory. The balance of the paint not used in testing will be returned to the sampling point. It is difficult to obtain small representative samples of these paints, whereas the Chemical Testing Branch has the equipment to properly remix and obtain representative samples. All containers of paint products must be labeled as required by the specifications. Paint requirements and application are covered in the special provisions, Section 91and Section 59 of the Standard Specifications, respectively.

4.2.5 Elastomeric Bearing Pads

Elastomeric (neoprene rubber) bearing pads are usually included in the cost of the structural steel item. Fabricators generally furnish these and they are shipped along with the completed steel girders. Advise fabricators to have these pads sampled and inspected at the point of manufacturer when possible. If not possible, the Fabricator must supply an extra bearing pad for sampling and testing. This pad is destructively tested and will not be returned. Dimensions of the pad thickness and spacing of fabric laminations must be checked for compliance with Sec. 51 of the Standard Specifications. Spacing of steel laminates will be determined in our Laboratory. Copies of the pad manufacturer's certificate of compliance and test report must be sent along with the test sample to the Structural Materials Testing Branch.

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4.3 INSPECTION OF FABRICATION

4.3.1 Shop Working Drawings

Working drawings are to be submitted in accordance with Section 55 of the Standard Specifications. These drawings are required to be submitted sufficiently in advance of the start of fabrication to allow time for review and approval by the Engineer so as not to delay the work. Most fabricators will not start fabrication until at least the initial set of submittals have been reviewed and approved. Fabricators may commence work if only minor corrections are requested. Corrections to drawings will be made and resubmitted with sufficient copies furnished for distribution. The Inspector will usually be able to get a copy of the approved working drawings from the Fabricator prior to final distribution. Drawings for railroad bridges will take longer to review. The Inspector is responsible for seeing that fabrication has been performed in accordance with the details of the approved working drawings. Any significant differences or omissions noted between the approved working drawings and contract plans should be brought to the Engineer's attention in a timely manner.

Requirements for working drawings are listed in Section 55-1.02 Drawings of the Standard Specifications. When working drawings are required, they shall be supplemented by the Fabricator's written quality control plan. Requirements for the quality control plan are listed in Section 8-3. **Welding** of the special provisions.

If the Inspector feels that there is an extraordinary delay in his receipt of approved working drawings, he should contact his supervisor. Errors in fabrication often require resubmittal of working drawings so that repair procedures are duly noted and approved in the final as-built drawings.

4.3.2 Layout and Assembly

4.3.2.1 Cutting of Material

Once material has been approved, it will be laid out and cut into dimensioned pieces. For flanges, webs, hanger plates, and other main girder components, the heat numbers must be recorded for future traceability. Cutting of material may be by shearing, sawing, or flame-cutting. Equipment used for cutting must be in good repair and capable of clean cuts to prescribed lines. The Inspector should observe cutting operations and immediately express his concerns when work is not acceptable. All flame cutting should comply with the workmanship requirements of AWS D1.5 Welding Code. Shears should make good clean cuts without appreciable tearing of materials. Bent edges and heavy shear drag will be evidence of poor workmanship. Beveling of edges by the use of mechanical "nibblers" shall result in accurate and consistent bevels that are true to line without appreciable tearing of the steel. All exposed cut edges of steel members shall have all sharp edges, fins, and slag removed and slightly rounded by grinding or other acceptable methods. Small notches and handling defects along cut edges may be weld repaired and ground smooth with the Inspector's approval. Repairs on edges of tension components should be approved by the Engineer, and the repairs subjected to nondestructive examination for soundness and absence of cracks. Repairs must be performed with approved welding processes and procedures.

During the shop layout for cutting, the orientation of plates must be observed. Tension components, such as flanges, splice plates, hanger plates, eyebars, etc., shall be cut and fabricated so that the primary direction of rolling of the steel is parallel to the direction of the main tensile stress or compressive stress in the member. Hanger plates are required to have the pin holes bored in pairs or in stacks firmly clamped to ensure matching.

4.3.2.2 Bolt Holes

Bolt holes may be punched and drilled full size, sub-punched and reamed, or sub-drilled and reamed. All finished holes shall be cylindrical, perpendicular to the plane of the connection, and sized properly for the nominal diameter of the bolt to be used. Holes shall be clean cut, without torn or ragged edges. All burrs, fins, sharp edges and hole irregularities, which would prevent solid seating of the parts, shall be removed. Holes for field joints will frequently be sub-punched or sub-drilled under the finished diameter and reamed to size during assembly. Sec. 55-3.14A Bolt Holes of the Standard Specifications list the requirements for bolt holes. Holes may be drilled using rotary twist or rotary broach drills. Slotted holes may be made by a combination of 2 drilled holes and flame cutting. Flame-cut edges must be cut undersize and the slot ground to finish dimension. Matching hole patterns in joining members are usually required to be drilled using steel templates with hardened steel bushings. The option to use computer numeric controlled (CNC) drills for matching hole patterns must be approved by the Engineer and a proof assembly of the joining parts may be required to ensure that the bolt patterns accurately match.

4.3.2.3 Bent Plates

Cold-bent load-carrying plates shall be fabricated in accordance with the requirements of Section 55-3.07 Bent Plates of the Standard Specifications. Essential items to remember are that direction of bending shall be at right angles to the direction of rolling of the steel, edges to be bent are rounded to a minimum radius as specified prior to bending, and the pin diameter is as specified. Any cracking in the edges will be grounds for rejection. Dye penetrant testing may be used to detect small or fine cracks.

4.3.2.4 Fit of Stiffeners

Requirements for stiffener fit-ups are stated in Sec. 55-3.06 Fit of Stiffeners of the Standard Specifications. Stiffeners should never be welded to the tension flange. For continuous bridge members, either the top or bottom flange may be the tension flange. Tension and compression flanges are usually detailed in the contract plans. The Inspector must verify that the shop working drawings correctly detail this, as a common error in shop fabrication is to weld the ends of vertical stiffeners to the tension flange. The end details for stiffeners will vary ("Tight-fit", "Mill to bear", seal welding on compression flange, and complete penetration welding for bearing stiffeners). The Inspector should closely observe the fitting of stiffeners as it is at this point where the Inspector can determine whether the correct detail is being used. General shop practice is to cut stiffeners long and trim and fit one end. It is essential that the specified copes on stiffener ends be to the dimensions shown on the approved working drawings. When copes are too small, it is difficult to blast and clean the area at the juncture of the web-to-flange fillet weld, and small copes create fatigue problems when the fillet weld is closer than specified to the flange. "Tight-fit" is defined as the end of the stiffener having at least point bearing at some point on the girder flange with the rest of the width not exceeding 1/16”. Sec. 59 requires that open seams or joints unable to be sealed by paint are required to be caulked with approved material prior to application of the finish coats.

4.3.2.5 Shop Assembly

All bolted or field welded joints are required to be shop assembled to ensure that all girder segments when erected and joined by bolting or welding will comply with required dimensions and geometry. All component parts of the field joint (splice, fill plates, etc.) are required to be match marked. Details of shop assembly are required to be in the shop working drawings. Requirements for shop assembly will be found in Sec. 55–3.16 of the Standard Specifications.

4.3.2.6 Bolted Splices

All high-strength bolted splices made at the job site or in a fabrication shop must comply with the requirements of Section 55-3.14, **Bolted Connections** of the Standard Specifications. If ASTM A 325 high-strength fasteners are being installed and preloaded, preliminary tests (including pre-installation tests and RoCap tests) shall be performed by the Contractor/Fabricator and witnessed by the Inspector. The Contractor is responsible for providing a calibrated bolt load meter (e.g. Skidmore-Wilhelm) and all other testing equipment required at the job site to do preliminary testing of fasteners (i.e., pre-installation tests and RoCap tests) and final checks of a joint. In addition, when referenced in the Contract, a copy of the RCSC Specification titled “**Specification for Structural Joints Using ASTM A 325 or A 490 Bolts**” and the **Structural Bolting Handbook** shall be present at the job site or fabrication shop where high-strength bolting is being done. If Direct Tension Indicators (DTIs) are being installed in conjunction with A 325 bolts, the Contractor and Inspector shall be familiar with installation requirements published by the DTI manufacturer, and shall have appropriate tapered feeler gages for inspection. The Inspector shall verify that proper installation procedures are being followed and bolts are accurately tensioned. Procedures for tension verification of a completed joint are specified in the special provisions and/or RCSC Specifications. When high-strength fasteners are fully preloaded in bolted connections, the use of a bolt-tension calibrator (e.g., Skidmore-Wilhelm) is required to perform pre-installation and RoCap tests, and to determine job inspection torques. Tensioning may be performed by using 1) either the calibrated wrench (torque or pneumatic) or turn-of-the-nut installation method, 2) a tension control fastener system or 3) direct tension indicator washers in conjunction with high-strength bolts, when so permitted. For members visible to traffic, the bolt heads shall be positioned on the side of the structural member facing traffic. Generally, specifications require that all contact (faying) surfaces of the bolted joint be blast-cleaned and painted with approved zinc primer. Outer joint surfaces beneath the bolt head and washer shall also be cleaned and primed. It is a contractual requirement that the Contractor follow requirements in the "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts", approved by the Research Council on Structural Connections of the Engineering Foundation. It is therefore necessary for the Contractor/Fabricator and Inspector to be fully knowledgeable of the bolting requirements in this document. When required/used, direct tension indicators (DTIs) must be installed following the DTI manufacturer's recommendations and any other requirements listed in the special provisions. Fastener components for our bridges are generally specified to be zinc coated. High-strength fasteners are usually specified to be zinc coated with nuts lubricated in accordance with Supplemental Requirements S1 and S2 of ASTM A 563.

4.3.2.7 Flatness of Bearing Surfaces

Flatness tolerances for bearing and base plates must be checked against the applicable specifications. General guidelines are provided in Sec. 55-3.05 of the Standard Specifications. The tolerances are generally dependent on the types of materials that make up the contact (faying) surfaces. Prior to inspecting, specifications, job specials, and contract plans should first be checked to determine specific flatness tolerances including those for any machined surface. Because of the high shrinkage forces inherent in a complete penetration weld that typically joins a bearing stiffener to the flange, the bearing flatness must be checked because the girder flanges may be distorted. For bearing surfaces of girders that come in contact with elastomeric bearing pads or concrete mortar, a flatness tolerance is generally specified. Flatness of bearings that are metal-to-metal or on ground concrete bearing surfaces are generally specified in the special provisions and should be checked. Bottom surfaces of bearing plates in contact with elastomeric bearing pads will usually require the same paint coatings as the girders.

4.4 WELDING INSPECTION - GENERAL

This section covers the duties and responsibilities of the Inspector in the area of welding inspection. Requirements may vary dependent on the welded product and reference specifications. Certain basic principles should be followed in conducting welding inspections and these are outlined in this section. The structural significance of the welded member may dictate more severe welding restrictions. For example, Fracture Critical Members (FCM) of highway bridges have the strictest welding requirements and the AWS D1.5 Bridge Welding Code, supplemented by a Fracture Control Plan, will govern welding. Miscellaneous bridge metal items on the other hand are governed by the AWS D1.1 Welding Code which is less strict. The Inspector must be flexible in making inspection decisions, as the specifications are not the same from contract to contract.

The Contractor/Fabricator is wholly responsible for welding quality control. Section 8-3. **Welding** of the special provisions requires that the Contractor follow a specific Quality Control Plan (WQCP). When welding is performed at a permanent fabrication facility that is an AISC Certified Fabricator, Category III Major Bridges (CBr), the requirements of Welding Quality Control may not apply. Fabricators are required under Section 55-1.02 Drawings to submit a written QCP. However, a written WQCP for welded steel products, listed in Welding Quality Control, must be submitted for the Engineer's approval. Preliminary to this submittal, a prefabrication or pre-welding meeting must be held with the Contractor or Fabricator to review all welding requirements. SMRs are assigned the responsibility of assisting the Engineer at these meetings. METS Lead Inspectors typically are assigned the review and approval of the WQCP. Requirements for the WQCP will be dependent on the type of welded products, governing welding codes, specific design requirements, etc. Inspectors must carefully review the special provisions and Welding Quality Control requirements as revisions are continually being made because of changes in welding technology and test methods.

Quality Assurance Inspection (QAI) of welding is the Engineer's prerogative. The purpose of QAI is to ensure that the Contractor's weld quality is in substantial compliance with the specification requirements. METS Inspectors will be responsible for QAI. Instructions in this manual must be followed. Standardized forms are furnished to achieve consistent and uniform QAI documentation. Changes in welding technology and testing specifications may result in revisions to the manual. The Inspector must be alert to any changes in the manual.

4.4.1 Qualification of Welding Procedures

One of the most important duties of the Inspector is the review and approval of the Welding Procedure Specifications (WPS). Written WPSs are required for all welding procedures performed by the Contractor. Depending on the code requirements, WPSs may be prequalified or need to be qualified by procedure qualification tests. If the WPS must be qualified by test, a Procedure Qualification Record (PQR) must be submitted for approval.

For other than the SMAW weld process a weld procedure qualification test will be required for all other welding processes when the AWS D1.5 Bridge Welding Code governs welding.

The review and approval of WPS/PQR submittals will be conducted in a timely manner by the Inspector in accordance with the instructions provided in this Manual. It is important that the welding specifications be thoroughly reviewed well ahead of welding and fully discussed in the prefabrication/pre-welding meeting to develop a common understanding between the Inspector and the Contractor/Fabricator. When procedure qualification testing is required, the WPS must first be reviewed for specification compliance (essential variables) and then the weld procedure qualification test witnessed by the Inspector. Every effort should be made to expedite review of the WPS/PQR so as not to delay the work schedule. Welding of test plates and laboratory testing and all related costs are the Contractor 's responsibility.

Some WPSs may be prequalified by the applicable welding code or previously approved by METS or a satisfactory independent third party (another State DOT or recognized independent agency). The Inspector shall verify that previously approved WPS/PQRs are within their period of effectiveness. Welding operators who conduct successful procedure qualification testing are automatically qualified for the welding process and position that is used in the test plate. The review of all WPS/PQR must be accurately documented on METS standard QA forms and filed and distributed as instructed.

The following are frequently used reference specifications for welded steel fabrication:

1. AWS D1.5 BRIDGE WELDING CODE

2. AWS D1.1 STRUCTURAL WELDING CODE (Commercial Code)

3. AREA/AASHTO FRACTURE CONTROL PLAN (Fracture Critical Members)

4. AREA (Railroad Bridges)

NOTE : The above welding specifications may be superseded and supplemented by the special provisions and Section 8-3. **Welding**.

In witnessing and reviewing WPS/PQR tests and submittals, the instructions provided in this Manual must be followed. The following are some of the essential variables and precautions in reviewing WPS/PQR tests:

1. Specification of Approved Base Metal
   <u>Note</u>: Maximum benefit from a WPS can be derived by conducting PQR on steels with a higher yield strength. A 50-ksi Fy will qualify 36-ksi Fy.

2. Approved Filler Metals and Fluxes – Obtain certified test reports from consumable Manufacturer and Shielding Gas supplier. Tests should be conducted within last year.
3. Test Plate – Verify that the joint details are as specified in the Code for either groove or fillet welds. For a non-standard joint, use the actual production joint. For AWS D1.5, two test plates will be required if WPS is to be qualified for Maximum-Minimum Heat Input.

4. Preheat, Interpass, and Postheat Temperatures – As required for thickness and steel grade. Special conditions may require higher temperatures.

5. Heat Input (kilojoules/mm) – Test to Maximum Heat Input or Max-Min. Heat Input
   Note: Heat input range must be listed on WPS.

6. Visual Inspection and Nondestructive Testing required prior to physical testing.

7. Machining of Testing Specimens – Use comparator to verify dimensions of Charpy Impact test specimens. Machining should be witnessed by the Inspector.

8. Physical Test Results – Verify test procedures, test machine calibrations, and correctness of test result calculations.

9. Procedure Qualification Test Record (PQR) – Must qualify the WPS.

4.4.1.1 Details of Weld Procedure Tests

1. Base Metal: Weld test plates must be of steel grades as specified to qualify the base metal to be actually fabricated. Verification of steel chemistry and impact properties may be required. Identifiable plates may be accepted on the basis of certified mill test reports. The weld axis must be perpendicular to the direction of rolling.

2. Electrodes/Fluxes: Grade of steel and any required CVN (Impacts) will govern the electrode, fluxes, and shielding gases that can be used. Approved filler metals and fluxes are listed in Code tables.

3. Weld Test Joint: Standard test plates shall be used if the joint details to be used are AWS pre-approved standard joints. For non-standard

joints, the actual joint used in production shall be tested. Test plate thickness depends on maximum production thickness.

4. Preheat, Interpass, and Postheat Temperatures: The required test plate temperatures for preheat, interpass, and postheat are governed by the thickness and steel grade used in production. Required temperatures are listed in Tables in the applicable welding code. Special conditions may require higher temperatures and will be listed in the special provisions or approved WPS. “Temp-stiks” or other surface temperature gages must be used to monitor these temperatures.

5. Essential Variables: Welding Machine: Electrodes, fluxes, shielding gas and flow, voltage, amperage, speed of travel, type of shielding gases and rate of flow, electrode stick-out, type of current and polarity, preheat, interpass and postheat temperature, number of passes, etc. must be listed in the PQR. The essential variables must be maintained within the targeted heat input range of the WPS.

6. Inspection: Visually inspect the completed welds for quality (size, profile, geometry, porosity, undercut, etc.) and verify that required NDT is performed prior to machining.

7. Machining: The weld procedure test plate must be machined to provide the required physical testing specimens (tensile, impacts, bends, macroetch). Charpy V-notch impact test specimens must be accurately machined to provide accurate test results. The testing laboratory must use an optical comparator to verify the dimensions of the Impact specimens are correct.

8. Physical Testing: Qualification testing of the weld procedure test plate specimens must be witnessed by the Inspector, and the calculated test results checked for accuracy. The witnessing Inspector must be knowledgeable of the testing procedures and ensure that the test procedures and equipment are adequate for the tasks. Current calibration of test machines must be verified. Charpy Impact test specimens must be maintained at the required test temperatures until the moment of testing. Test results must be verified for compliance with the specified test requirements. The witnessing Inspector shall sign all WPS/PQR test records.

9. WPS/PQR: The WPS and PQR submittals of the Contractor/Fabricator shall be reviewed in accordance with the guidelines this QA Manual. Test data shall agree with the originally witnessed test data. The WPS must list all essential variables and the

permissible heat input range to be used in production. WPS/PQR submittals that meet all specified requirements shall be approved or rejected by the Branch Chief (P.E.) and promptly returned to the Contractor. If the submittal is rejected, the reasons shall be so stated.

4.4.2 Welders and Welding Operators

The Inspector is responsible for verifying the qualifications of all welders, welding operators, tackers, and stud welders, as required by the applicable welding code, contract specifications, and Section 8-3. **Welding** of the special provisions. The procedures for reviewing and reporting the Qualification Test Record submittals are listed in this manual. These are included at the end of this Part 4. Submittals must list the weld process, welding position, electrodes/fluxes, steel type and date of qualification test and the testing agency and witnessing authority. Qualifications must be verified for all production groove and fillet welding.

Previous qualifications must have been conducted by an independent third party acceptable to the Engineer. The welders' and operators' qualifications must be within the period of effectiveness, as defined in the applicable welding code or contract special provisions. The maximum period of effectiveness for qualification tests is three years for welding governed by the Welding Quality Control special provisions. AWS Codes allow indefinite qualification unless the welder or welding operator is not engaged in the process qualified within the last six months. The Inspector may require requalification whenever there is specific reason to question the welder's or operator's ability.

Unacceptable or non-current welders and welding operators must be requalified. Qualification testing must be performed in accordance with the applicable welding code or special provision requirements. Qualification must be conducted for the welding process, welding position for groove or fillet welding, steel grade, and thickness. For welding performed on weld joints that are not prequalified by the Code, qualification tests must be performed on the non-standard joints that are used in actual production.

Standard qualification test plates are detailed in the welding code for groove welding on limited and unlimited thicknesses. A separate test may be used for fillet and tack weld qualification only. However, most welders and operators to maintain steady employment must be qualified for both groove and fillet welding. A standard single-vee groove weld test plate, 3/8" thick for limited thickness (maximum 3/4") and a 1" plate for unlimited thickness is used to qualify welders and operators for both fillet and groove welding. Qualifications on any of the approved base metals listed in the Code qualify for welding all steels up to a maximum of 90-ksi yield strength.

The following lists the most commonly used welding processes and welding positions for which welders and welder operators must be qualified:

4.4.2.1 Welding Processes

SMAW: Shielded Manual Arc Welding (“Stick”)
FCAW-S: Flux Cored Arc Welding, Self-shielding
FCAW-G: Flux Cored Arc Welding with Gas-shielding (“Dual Shield”)
SAW: Submerged Arc Welding
GMAW: Gas Metal Arc Welding (“MIG”)
SW: Stud Welding
ESW: Electroslag Welding

<u>Note</u>: Electroslag and Electrogas processes are not permitted for members in tension or stress reversal and therefore seldom used for welding bridges.

4.4.2.2 Welding Positions (Fillet and Groove Welds)

Flat: Fillet 1F, Groove 1G
Horizontal: Fillet 2F, Groove 2G
Vertical: Fillet 3F, Groove 3G *
Overhead: Fillet 4F, Groove 4G *

* Welders qualified for both 3G and 4G are qualified for all positions, both groove and fillet welds.

Steel fabricated in the shop is generally welded in the flat or horizontal positions. The flat position is the easiest and most cost efficient and also the only permitted position for submerged arc welding of groove welds. The most cost efficient processes will generally be chosen. For field welding, the welders are generally all-position (flat, horizontal, vertical and overhead) welders. The position and site conditions (GMAW may not be used where wind velocity exceeds 8 kph) often control the weld process used. Most shop welding will be performed using semi-automatic or automatic welding processes (SAW, FCAW-G, FCAW-S, GMAW). The SMAW and FCAW-S processes are the most popular for field welding. Generally, previous qualification tests, accepted by other independent agencies and which are within the specified period of effectiveness, will be acceptable. All qualification tests will be at the Fabricator's expense. Welding of test plates and their testing shall be witnessed by the Inspector when qualification testing is required.

4.4.3 Welding Workmanship

4.4.3.1 General

The Inspector is responsible for the Quality Assurance Inspection (QAI) of all phases of the welding workmanship. Requirements for workmanship are contained in the reference welding code or as otherwise superseded by the special provisions. For most contracts either the AWS D1.5 or D1.1 Welding Codes will govern. Whenever a conflict exists between the contract special provisions, contract plans, or AWS Welding Code, the order of priority is the special provisions, contract plans, AWS Code. The general reference code for welding is listed in Section 55-3.17 Welding of the Standard Specifications. For Fracture Critical Members the Fracture Control Plan of AWS/AASHTO or AREA will take priority.

4.4.3.2 Preparation of Base Metal

All cutting (flame-cutting, shearing, sawing, etc.) shall produce surfaces and edges acceptable for welding. Weld joint preparations (face, land, groove angle, etc.) must be within allowable tolerances. Cutting must be true to line, especially for edges prepared for field welded joints, and free from fins, tears, and cracks. The use of mechanical "nibblers" should not be allowed if acceptable edges and straight cuts cannot be maintained. Cut edges must be within the surface roughness tolerances for flame cut edges as specified in AWS D1.5 Welding Code. This specification allows a maximum surface roughness for material of different thickness, and whether in tension or compression. Specifications require that all mill scale be removed from surfaces where girder web to flange welds are made. Notches, gouges, and other defects along edges within allowable specification limits may be repaired by welding and grinding. A repair procedure must be submitted and approved for all critical weld defects. Such repairs may be subject to nondestructive testing, particularly on tension members. Surface and edge repairs on 100-ksi steel (ASTM A 514) must be submitted for approval by the Engineer.

Mill defects, such as laminations and non-metallic inclusions in plates, may be removed and weld repaired if conducted in strict accordance with the repair procedures allowed in the specifications. ASTM A 6 govern the dimensional and surface requirements for structural steel bars, shapes, and plates. Required mill markings on delivered steel will identify the producing mill and steel specification to which the steel was produced.

4.4.3.3 Assembly (Fit-up)

The assembly (fit-up) requirements for both fillet and groove welds shall conform to specified tolerances of AWS D1.5 or AWS D1.1. Parts to be joined by fillet welds shall be brought into as close contact as practicable. If the fit-up opening exceeds allowable tolerances, the fillet weld leg size shall be increased proportionately. The root openings for groove welds and alignment of joint must be maintained within specification tolerances.

Allowances should be made for warpage and distortion caused by weld shrinkage. Positioning of component parts by offsetting or slight pre-bending of plates to compensate for anticipated shrinkage is not uncommon. This minimizes the amount of corrective straightening which might result. With the correct welding sequence, the effects of weld shrinkage can be minimized and dimensional stability maintained.

For bridge girders, camber is cut into the web plates. It is not unusual for the experienced shop to cut web camber in excess or less than that detailed on the working drawings. This is with the knowledge that the sequence of welding and resultant weld shrinkage will affect the final girder camber. Camber can also be affected by the shrinkage of stud welding (shear connectors) welded on girder top flanges. Experienced shops make many fit-up adjustments of components.

4.4.3.4 Tack Welds

The most common use of tack welds is fitting up weld joints and component pieces in preparation to being fully welded. Tack welds are subject to the same quality requirements as the final weld. Good welding practice will result in tack welds being consumed in the completed weld. Tack welds used to fit-up groove welds should be made in the root of the weld. Tack welding during assembly (fit-up) of component pieces should be kept to the minimum size and number necessary to hold the assembly together without the tack welds cracking. Requirements for tack welds and qualification of tackers on bridge girders are specified in the AWS D1.5 Bridge Welding Code. Tack welding of weld backing for groove joints should be done within the joint itself so that they are consumed in the completed weld; the same applies for run-off extensions. When groove welds with backing bars are permitted to be attached externally on bridge tension members, the backing bars shall be continuously fillet welded the full length of the backing bar. Splices in backing bars shall be complete penetration welds and are subjected to the same NDT as tension members. For members not subjected to cyclic loading and fatigue stresses, such as the steel column casings used to seismic reinforce concrete columns, these restrictions may be waived, as reflected by contract plan details.

Tack welding of dogs, clips, alignment straps, etc. should not be allowed on surfaces and edges of bridge members. Approval of welded attachments shall be made with adequate preheat and magnetic particle inspection (MT) of the welded areas after the removal and grinding smooth of the weld attachment area. The use of such welded devices on main tension members must not be permitted. In the final loadout of members, this attachment of unauthorized steel bracing must not be allowed. The welded attachment of erection devices and aids requested by the Contractor must be approved by the Engineer. The Inspector must be constantly alert to unauthorized welding, particularly to tension members.

INDISCRIMINATE USE OF TACK WELDS CAN RESULT IN PREMATURE FAILURE OF CRITICAL STRUCTURAL MEMBERS !!!!

4.4.3.5 Welding Sequence

The sequence of welding in the joining of major component parts of built-up bridge members is required to be noted on the approved working drawings. Basic controls for a good welding sequence are covered in AWS D1.5 Bridge Welding Code. A good welding sequence will balance the applied heat of welding while the welding progresses. The direction of the general progression of welding shall be from points of greatest restraint, where parts are relatively fixed, to other parts which have less restraint or a free end. A properly executed welding sequence will result in the least distortion and minimize damaging shrinkage stresses.

4.4.3.6 Production Welding

The Inspector shall verify that welding is performed in accordance with an approved welding procedure and with certified welders and operators. Copies of the approved WPS must be readily available to the welders/operators as well as the Fabricator's Q.C. Inspector. All welding consumables (electrodes, fluxes, and shielding gases) must be as stated in the WPS. These shall be properly packaged, stored, and dried in accordance with the specification requirements for the welding process being used. Holding ovens shall be capable of storing the consumables at the required temperatures. Certifications for the welding consumables must be supplied by their manufacturers prior to approval of the welding procedures. For Fracture Critical Members and high strength quenched and tempered steels, certifications may be required for the specific lots of consumables.

The Inspector must check the applicable specifications for the packaging, storage, and drying of welding consumables. The intrusion of hydrogen into the weld metal can lead to cracking and premature failure through brittle fracture as a result of "hydrogen embrittlement." Any moisture in trace amounts can have damaging effects to the fatigue life of welds and result in both premature and catastrophic failure of bridge structures. The AWS D1.5 Bridge Welding Code and the Fracture Control Plans for Fracture Critical Members have stringent requirements for protecting the welding consumables from moisture intrusion. Specific requirements for the storage and drying of welding consumables must be observed. One of the most important functions of the Inspector is to see that these requirements are strictly enforced. The specifications must be reviewed for each contract to be certain of the specific requirements; however, the following major precautions are generally listed:

- SMAW Electrodes: Shall be purchased in hermetically-sealed containers or dried according to specification requirements before use. Electrodes taken from hermetically-sealed containers or storage ovens must be used within the permissible atmospheric exposure limits specified or returned to the holding oven for the time and temperature specified. Requirement for consumables used on 100 ksi steels and Fracture Critical Members are more stringent. Certified copies of test reports for all required qualification tests shall be furnished or be on file for the electrode class, size, and brand. The tests shall have been made within one year prior to the manufacture of the electrode furnished.

- SAW: The Fabricator must furnish certified copies of test reports for all electrode and flux combinations used. Tests shall have been made within one year prior to the manufacture of the electrode. All flux shall be purchased in packages that can be stored, under normal conditions, for at least 6 months without effecting its welding characteristics. Flux from damaged or open packages can be used if dried according to specifications. Flux must be placed in the dispensing system immediately upon opening a package, or, if used from an open package, the flux shall be dried or the top one inch shall be discarded. All flux dispensed into the welding equipment shall be replaced with new or freshly dried flux whenever welding operations have ceased for more than 48 hours.

- GMAW/FCAW: The Fabricator must furnish certified copies of test reports for all electrodes and combination of shielding. Tests shall have been made within one year prior to the manufacture of the electrodes. A certification shall also be furnished by the shielding gas manufacturer who shall certify that the gas or gas mixture is suitable for the intended application and will meet the dew point requirements. Diffusible hydrogen tests will be required for FCAW electrodes used on Fracture Critical Members.

Weld joints shall be prepared in accordance with the approved WPS. For both fillet and groove welds, run-off extensions shall be used whenever possible to ensure sound weld terminations. Run-off extensions shall be removed and ends ground smooth after welding and before any radiographic testing is performed.

Welders and welding operators shall have been certified for the process, position, and type of welds being made. Each operator must be capable of setting up the welding equipment used. For shop fabrication, either semi-automatic or automatic processes are most frequently used. Quality of the welds is largely dependent on the welding equipment. The Inspector should verify that welding equipment is in good working order and all of the instruments necessary to measure the welding parameters are in both good working order and accurately calibrated. Independent voltmeters and ammeters should be used to monitor the instruments on the welding machines. Travel speed and rate of flow of shielding gases must also be monitored. The WPS-approved heat input range must be checked against that actually used, so it is essential that the voltmeter and ammeter on the machines are accurate. For the SAW and FCAW welding processes the welding procedures must be operated between 60 percent and 100 percent of the maximum heat input that was tested and approved. For WPSs qualified for maximum-minimum heat input, the production heat input must be within the qualified range.

4.4.3.7 Preheat, Interpass and Postheat Temperatures

The preheat and interpass temperature stated on the WPS must be adhered to as they affect the cooling rate and heat input. Welders and Inspectors should have either temperature crayons ("Temp-stiks") or surface thermometers to monitor these temperatures. The specified preheat and interpass temperatures instructions listed in the approved WPS must be adhered to. When postheat is specified, the temperature and duration of time must be monitored. Special conditions may require deviations from the Code tables.

4.4.3.8 Nondestructive Testing (NDT)

NDT procedures, personnel and equipment are required to be listed in the Contractor/Fabricator's QCP. The Inspector shall verify that nondestructive testing, including the type, locations, and frequency, required by the specifications has been performed and substantially conducted in accordance with the specified requirements. This shall include confirming Level II certifications of all of the Contractor's NDT Inspectors, the performance of the specified NDT, periodic witnessing of NDT, verifying proper equipment calibration, and, documentation of all tests, including weld repairs. Personnel performing NDT shall be certified in accordance with the requirements of the American Society of Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the Written Practice of the NDT firm. For Fracture Critical Members, weld repairs must be carried out in strict accordance with the Fracture Control Plan and fully documented by the Inspector. QA inspection and documentation of the Contractor's NDT shall be as directed elsewhere in this manual.

Requirements for all NDT are detailed in the contract documents. QA shall verify no less than ten percent of the NDT performed by quality control by performing the specified NDT. Personnel performing NDT shall be certified in accordance with the requirements of the ASNT Recommended Practice No. SNT-TC-1A and the Written Practice of the Office of Structural Materials or approved outside entity.

Problems involving NDT, which are beyond the scope of the Inspector's capabilities, should be referred to his Supervisor. Certified Level II NDT personnel may be called in to monitor the NDT procedures at the outset of a job or whenever there are NDT problems or evaluations to be made. Because of the hazards of radiation, all Inspectors must follow all radiation safety rules. Responsibility for specified NDT and related costs are the Contractor's.

Section 8-3. **Welding** provides for additional NDT to be ordered by the Engineer. The costs of additional NDT will be borne by the State. The cost of repair of any weld deficiencies found by such additional NDT will be at the Contractor's cost.

NONDESTRUCTIVE TESTING REQUIREMENTS FOR QC PERSONNEL:

- Joints to be inspected must be selected by the QC Inspector with the percentages of welds to be examined as stipulated by the specifications. Weld joint surfaces must be properly prepared for the NDT to be employed.

- The QC Inspector must ascertain that equipment, procedures, and techniques are in accordance with specifications and all personnel performing NDT are ASNT Certified Level II technicians.

- The QC Inspector must maintain a record of all locations of inspected areas with the NDT report numbers and the findings of all tests, together with the method of repairs, and the NDT test results for all weld repairs.

- For radiographic testing (RT) the size and type of film, size and type of image quality indicators (hole penetrameters or wire type), identification markings, and proper film processing within the acceptable density range must be as specified. An approved high intensity viewer and densitometer is necessary to evaluate the film. Accurate interpretation of film for weld defects requires both Certification and experience. The QA or QC Inspector must not be hesitant to consult with his/her supervisor or designated Level III whenever he/she is uncertain. Final interpretation of radiographic films will be conducted by an individual certified as a Level II Radiographic Film Interpretation Technician.

- For ultrasonic testing (UT), the QC Inspector must be sure testing instruments are of the specified type and accurately calibrated at each usage; the weld and adjacent surfaces prepared to allow proper coupling; both straight and angle beam transducer are used for both welds and adjacent base metal and all test results accurately documented as specified.

- A percentage of fillet welds and some weld repairs are required to be magnetic particle tested (MT). All welds and surfaces to be tested shall be dry and free of contaminants and properly prepared. The yoke method of testing using half wave direct current or alternating current in accordance with ASTM E 709 is the preferred method. A report of magnetic particle inspection must be furnished which accurately reports the welds tested, examination results, and testing equipment used must be furnished.

The guidelines for the monitoring and recording of NDT inspections listed in this manual must be followed.

4.4.3.9 Weld Repairs

Defects found by visual or nondestructive testing are normally allowed to be repaired if a sound weld can be attained, and there are no restrictions for the specific type or extent of the defect. The repair must be made with an approved welding process and approved procedure. The required preheats must be maintained and in some cases additional preheat must be used. The Fabricator must submit a repair procedure. For quenched and tempered steels and repairs to welds in Fracture Critical Members, an approved repair procedure must be submitted and approved by the Engineer. The extent and location of all defects and repairs must be documented in the Inspector's reports.

The entire defect must be removed by chipping, machining, air carbon arc gouging, oxygen cutting, and grinding. The defect shall be removed to sound weld or base metal. The removed area should be kept to a minimum but still allow the welder sufficient access to make a sound repair. The weld repair must be ground smooth to the required finish and then nondestructively tested in accordance with the requirements for the original weld or as dictated by an approved weld repair procedure. Frequent and large repairs are indications of poor Fabricator QC, incompetent welders or operators, bad welding equipment, and improperly stored consumables. When there are a large frequency of weld defects, the Inspector must confer with the Fabricator and locate the source of the problem before welding resumes.

4.4.3.10 Final Weld Finish

The Inspector in performing final visual inspection of welds must see that the final weld finish meets specifications. All fillet weld profiles shall be within final dimensional requirements for leg and throat size, and surface profile reinforcement. Bumps and craters due to starts and stops, weld rollover, insufficient leg and throat, and excessive undercut must be ground and weld-repaired to an acceptable finish. If magnetic particle testing (MT) is required for fillet welds, the final finish of the weld must be such to allow tests to be properly evaluated. Some contract requirements may require welds to be grounds smooth. AWS D1.5, Section 3.6.3 and 3.6.4 shall also be reviewed if AWS D1.5 applies. A flush surface is one that does not exceed 1 mm of weld reinforcement height. The grind direction in producing flush or smooth weld surfaces must be parallel to the direction of primary tensile stress. It should also be noted that groove welds required to be nondestructively tested shall have surface reinforcement ground to an acceptable finish with all runoff tabs removed to allow accurate interpretation of radiographic and ultrasonic test results. When multiple flange widths are welded in a single plate, the individual flange plate widths must be "stripped" prior to any nondestructive testing.

4.4.3.11Stud Welding

The requirements for Stud Welding are contained in Section 7 of the AWS D1.5 Bridge Welding Codes. The Inspector must see that the stud materials and their welding are in full compliance with the specifications. The manufacturer's certification must be furnished to verify material and production compliance. Heavy rust and mill scale will cause poor welding and these and any moisture should be removed from the surface to be stud welded. A pre-production test is required to test the studs, welding equipment, and operator at the beginning of each day's or shift's production on the first two (2) studs welded. Visual inspection to verify 360 degrees of weld flashing and bend testing to see if the studs can meet a 30 degree bend are the required tests for a satisfactory weld procedure. Repairs can be made for missing flashing by fillet welding with low hydrogen electrodes. Normally, studs will be attached by flash butt welding using the manufacturer's gun with adequate power source. Bad grounding is a common problem and the ground leads should be examined for good contact. For small quantities of studs, the Fabricator may elect to attach the studs by fillet welding. This is acceptable, provided the specified fillet weld size is used. Stud welding inspection can be accomplished by good visual inspection and "ringing" the studs with a heavy hammer.

4.4.3.12 Warpage and Distortion

All welded steel assemblies suffer from the effects of shrinkage forces developed in the welds and base metal during the welding operation. Dependent on the types of welds, thicknesses of steel, design features, weld procedures, and weld sequences, the resultant amount of warpage and distortion that develops may not be within the allowable dimensional tolerances which are listed in the AWS D1.5 Welding Code.

For bridge girders, tilt of flanges and web buckling ("oil-canning") are details that the Inspector should evaluate in his final inspection after welding. Wracking and twisting of built-up box sections may also occur. Where corrections are allowed for straightening, these will generally include the application of localized heats and mechanical force. Heated areas should not be cooled with the direct application of water. For all major distortions the Fabricator must submit his correction procedure for approval. Often the complete replacement of a girder section or piece may be the only solution.

4.4.3.13 Fabricator's Quality Control

The AWS Welding Codes specify quality control (QC) as the responsibility of the Contractor. Section 8-3. **Welding** lists in more details these responsibilities. The Contractor is required to perform all inspections and testing to verify that an acceptable product is being furnished in accordance with the contract documents. A written Quality Control Plan (QCP) must be furnished, when specified by the contract documents. Most modern bridge fabrication shops are AISC Certified Category III (Major Bridge) Fabricators. As an AISC certified shop, they must have a defined QC program, which is a requirement for plant certification. Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector must see that the Fabricator is performing his QC program in a serious and meaningful manner and his QC personnel are diligent in the performance of their QC responsibilities. A written QC program is required to be submitted under Welding Quality Control and Section 55-1.02 Drawings of the Standard Specifications. When a written QCP submittal is required, this must be furnished and approved by the Engineer prior to fabrication. The QA Inspector must carefully review the Contractor/Fabricator's QCP and ensure that it is being fully executed.

Guidelines for the QA responsibilities of the QA Inspector are provided in this Manual. These guidelines must be closely followed and the specific QA documentation fully and timely completed. The responsibility for Quality Assurance Inspection (QAI) is that of the Caltrans Inspector. Essentially, this means that during the course of steel fabrication, a system of periodic inspections are conducted of all phases of the work to provide reasonable assurance that the Fabricator is in substantial compliance with all the specification requirements and is fulfilling all his stated QC commitments which are included in his written QCP. No work must be released until the Inspector is reasonably sure that all aspects of the QC and QA inspections have been fulfilled. The Supervising Inspector must monitor the work of subordinates to ensure that these inspections are being properly performed and documented. The Supervising Inspector is responsible for maintaining uniform and consistent QA inspections and documentation of the work.

For bridges with Fracture Critical Members (FCM), the contract specifies a Fracture Control Plan (FCP) which requires a higher level of testing and inspection. It is essential that the Quality Control and Quality Assurance inspection requirements be fulfilled.

4.4.3.14 Inspection Records

The Inspector is required to maintain concise and timely records, which are necessary to manage the Quality Assurance inspection function. These records are documented evidence that the Inspector has properly executed his inspection responsibilities and provide a method by which his Supervisor can easily review the Inspector's work at any time. Occasionally there may be claims made by the Contractor/Fabricator in which the Inspector may have somehow contributed to unnecessary delays in the work. Inspectors shall utilize the Welding Inspection Checklist located in Appendix J when performing inspections of steel products. This includes but is not limited to “OK to cuts”, material identifications, sign structures, signal and lighting poles, welding, miscellaneous metal, in-process inspections, nondestructive testing, and final material releases. The checklist is not required for friction welded or electric resistance welded rebar. Proper record keeping, particularly daily diaries, are of utmost importance in protecting the Department of unwarranted claims when the Fabricator initiates litigation. All applicable QA inspection forms referenced in Section 1 of this Manual must be fully and promptly completed.

Our ability to function as a useful and efficient Department depends on a high degree of consistency and uniformity among all our Inspectors. The Contractor/Fabricator is also entitled to uniform and consistent interpretation of specifications from the Department's Inspectors. The Fabricator wants all of his competition to be treated in the same manner. One of the most important functions of the Supervising Inspectors is to achieve a high degree of uniformity and consistency in the Department's QA inspection practices. Good communications amongst the Department's branches is essential. An important aid in this goal is that the documentation and record keeping be complete and timely transmitted to the Inspector’s Supervisors. In Appendix C are standardized forms which Inspectors are instructed to use.. These forms are for general application, and the Inspector may in some instances have to make minor modifications where special conditions might warrant. Major alterations or establishment of new forms should not be done without consultation with the Supervisor. Oftentimes, similar forms used by the Fabricator may be acceptable.

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4.5 PROTECTIVE COATINGS (BLAST AND PAINT)

4.5.1 General

Cleaning and painting are covered in the Standard Specification Section 59 and the Standard Special Provisions. In addition, the standards usually refer to the Society for Protective Coating (SSPC), formerly the Structural Steel Painting Council, standards for painting structural steel.

Paint shall be sampled and tested according to Section 91 of the Standard Specifications and any other applicable special provisions.

If required by the special provisions, the contractor shall submit a Paint Quality Work Plan 9PQWP) to the Paint Program Coordinator in the Division of Structure Maintenance and Investigation at (916) 227-8627 for review and approval. Two weeks time is required for the review process. The PQWP should include at least the name of painting contractor, current SSPC documents, proposed methods and proof of required SSPC certifications.

4.5.2 Certifications

Effective January 1, 2000 and depending on the size of the job, painting contractors shall have the following certifications at the time of bid and throughout the duration of the work:

a) SSPC-QP 1 for cleaning and painting structural steel in the field.
d) SSPC-QP 2 for removal of paint from structural steel.
e) SSPC-QP 3 for shop painting.

4.5.3 Weather Conditions

Limitations on steel surface and atmospheric conditions are set in the contract documents. Close attention should be made when waterborne paint is specified. Application of paint will not be permitted if it can be anticipated that atmospheric temperature or relative humidity will not remain within the specified conditions during the drying period.

4.5.4 Application

4.5.4.1 General

a) The contractor shall notify METS for inspection at least one week prior to the work being conducted.
b) Inspectors shall use the following checklists (derived from the Standard Special Provisions) during their inspection of preparation and cleaning,

coating new steel and Inorganic Zinc-Waterborne, Coating of Inorganic Sinc-Solvent Borne:

4.5.4.2 Preparation and Cleaning

1. Airless spray shall not be used.
2. Repair deficiencies in each coat before apply next coat.
3. Painted covered areas shall be free from moisture, dust, dirt grease, oil, and any deleterious material.
4. Water rinse if seven or more days between applications.
5. Paint shall be thoroughly mixed mechanically.
6. Contractor to provide protective devices.
7. Blast-clean all new metal surfaces to be painted. Prepared surfaces should be as required by the SSPC standard for commercial blast and near-white blast cleaning.
8. Solvent cleaning precedes all other cleaning operations.

4.5.4.3 Coating New Steel, Inorganic Zinc-Waterborne

1. Surface preparation: Mineral and slag abrasives accompanied by certificate of compliance. Near white blast cleaning as per SSPC Standards applied in a dense, angular, and uniform matter. The blast-cleaning profile depth shall not be less than 40 or greater that 86 um (1.5 to 3.4 mills).
2. Single undercoat in two applications within four hours of cleaning.
3. Conventional spray with agitated pot.
4. Dry film thickness 4 to 8 mills (100-200 um).
5. Final coat: Applied to visible surfaces only after the previous coat had been properly cured and adhesion tests had passed. Surface shall be lightly roughened with sweep blast and apply final coat within 24 hours at 25 to yr um.
6. Finish Coats: Used for aesthetics and normally applied to exterior faces of girders and exposed areas of bent caps. Apply first coat within 48 hours of water rinse. Second coat applied after minimum 12 hours of first coat.

4.5.4.4 Coating with Organic Zinc Solvent Borne

1. Use only in case of galvanizing repair, minor touch-up, coating cut ends of pre-stressing steel, exposed threads on galvanized pipes, cut edges on various metal components, and miscellaneous metals as called for on plans.

2. Surface preparation: Sacrificial coating; needs intimate contact with steel. Remove dirt, grease, and old paint. Thorough wire brushing may be acceptable and called for.
3. Application: Spray cans are not permitted. Use gray zinc for galvanizing repair. Mix according to manufacturer's directions. Must use mechanical mixer.

4.5.5 Adhesion & Cure Tests for Inorganic Zinc Coating

1. Minimum adhesion of four MPa is required.
2. No more than six locations per girder.
3. Use self-aligning tester as per ASTM D4541.
4. Contractor to perform adhesion tests and furnish results to Engineer.
5. Follow project documents on required cure test. Quarter test may be used to test for cure. Zinc shall exhibit a solid, hard and polished surface when firmly scraped with the knurled edge of a quarter. Coating that is powdery, soft, or does not exhibit polish surface shall be repaired by blast cleaning and repainting at Contractor's expense.
6. Cure test for finish coat shall follow procedure in ASTM D4262. Surface PH must be less than 8.

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4.6 BAR REINFORCEMENT: SPLICING

4.6.1 General

Bar reinforcement is made continuous by lap splicing or butt splicing. This section of the OSMPP details service and ultimate butt splicing requirements as specified in the Standard Specification Section 52-1.08 amended November 2003.

The main types of butt splicing are complete joint penetration welding, resistance welding and mechanical coupling. Mechanical splicing is generally done in the field and resistance butt welding is done in a fabrication shop. Although rare, some projects, such as repair jobs, require splicing by complete joint penetration welding.

4.6.2 Pre-qualification

Before any service or ultimate splices can be used, resistance welding machines and mechanical couplers must be on the Department's approved products list (www.dot.ca.gov/hq/esc/approved_products_list/.)

Before manufacturing hoops using resistance butt welding, the Contractor submits to the RE the manufacturer's Quality Control (QC) manual for the fabrication of hoops. The QC manual contains the following:

- The pre-production procedures for the qualification of material and equipment
- The methods and frequencies for performing QC procedures during production
- The calibration procedures and calibration frequency for equipment
- The welding procedure specification (WPS) for resistance welding
- The method for identifying and tracking lots

The Contractor's designated QC Manager, who reviews and approves all documents before submitting them to the RE, reviews and approves the Splice Pre-qualification Report (SPR). The RE then reviews and approves the SPR. The SMR should request a copy of the SPR if the RE did not provide one. The SPR contains the following:

- Splice material information
- Names of operators who will be performing the splicing
- Descriptions of the positions, locations, equipment and procedures to be used in the work
- Certifications for pre-qualification of operators and procedures
- Certified test results for all pre-qualification sample splices

Operator and procedure certifications are valid if they are based on sample tests performed within the last two years. Each operator is certified by performing two sample splices for each bar size of each type of splice type that the operator will be performing on the work. For deformation-dependent types of splice devices, each operator is certified by performing two additional samples for each bar size and deformation pattern that will be used in the work.

4.6.3 Inspecting, Sampling and Testing

One lot of production splices contains 150 splices, or fraction thereof. Each lot of production splices is QC tested. QC samples go to the independent testing laboratory, which is required to have the following:

- Proper facilities, including a tensile testing machine capable of breaking the largest size of reinforcing bar to be tested with minimum lengths as shown in the amended standard specifications.
- A device for measuring the total slip of the reinforcing bars across the splice to the nearest 25 µm, that, when placed parallel to the longitudinal axis of the bar is able to simultaneously measure movement across the splice, at two locations, 180 degrees apart.
- Operators who have received formal training for performing the testing requirements of ASTM Designation: A 370 and California Test 670.
- A record of annual calibration of testing equipment performed by an independent third party that has 1) standards that are traceable to the National Institute of Standards and Technology, and 2) a formal reporting procedure, including published test forms.

Quality Assurance (QA) sample splices are sampled and tested on the first, and at least one randomly selected of the next five, lot of production splices. QA samples, which are used to verify production splice test results, are in addition to QC samples. QA samples go to the Translab. Each sample contains eight (four to independent Lab and four to Translab). Ultimate splices require eight control bars in addition to the splices. The laboratories will test neither bundles containing less than four splices nor bundles not accompanied by the proper documentation.

4.6.3.1 Service Splices

Service splice locations are indicated on the plans. Service splices are typically used to splice reinforcement in elements that are not expected to undergo significant post-yield straining, such as bent caps, column flares and bridge superstructures. Service splices be resistance welded, mechanically coupled or complete joint penetration welded.

4.6.3.1(1) Resistance Weld

- Pre-qualification: See 4.6.2
- QC sampling (Production Test Requirements):
  - Contractor prepares samples.
  - Four splices from every lot of production splices.
  - Samples should be 1.5-m long for #25 and smaller, and 2-m long for #29 and larger.
  - Securely bundle sample splices together.
  - Contractor identifies the samples as "Production Service" and fills out the TL-0101 before shipping.
  - Send samples to the independent testing lab.
- QA sampling (Quality Assurance Test Requirements) is the same for QC sampling, except:
  - The first, and at least one randomly selected of the next five, lot of production splices is sampled and tested.
  - QA Inspector randomly selects the samples (four to the independent lab and four to Translab) and places tamper proof markings on all samples.
  - Contractor identifies the samples as "QA Service" and fills out the TL-0101 before shipping.
- Test Requirements:
  - Contractor notifies Engineer at least one week prior to testing.
  - Tensile requirement: minimum tensile strength of not less than 550 Mpa for three out of four samples.
  - No sample will be below 420 Mpa.
- Acceptance Criteria:
  - Test splices for tensile strength
    - If at least three splices pass the tensile requirement, the lot is acceptable.
    - If only one sample passes, the lot is rejected.
    - If only two samples pass, retest four additional splices from the same lot. If all four pass, the lot is acceptable. If any one fails, the lot is rejected.

4.6.3.1(2) Mechanical

- Pre-qualification: See 4.6.2
- QC sampling: Same as 4.6.3.1(1)
- QA sampling: Same as 4.6.3.1(1)
- Test Requirements: Same as 4.6.3.1(1) In addition and prior to tensile tests, one of the four samples shall conform to the requirements for total slip as specified in Section 52-1.08B(1).
  - Tensile requirement: minimum tensile strength of not less than 550 MPa.

- Acceptance Criteria: Same as 4.6.3.1(1); however, slip test requirement must be met first.
    - Slip test requirement:
        - Test one splice for slip.
        - If this splice fails the slip requirement, test remaining three for slip. If any of the three fail, the entire lot is rejected.

4.6.3.1(3) Complete Joint Penetration Weld

Primarily used on repair jobs, complete joint penetration welds are rarely used to splice reinforcing steel. See Amended Standard Specification Sections 52-1.08B(2) for welding requirements and 52-1.08C(3)(c) for non-destructive test requirements.

- Pre-qualification:
    - Welder and welding procedure must be qualified per AWS D1.4.
    - Check for SPR approval.
- QC sampling: Same as 4.6.3.1(1)
- QA sampling: Same as 4.6.3.1(1).
- Test Requirements: Same as 4.6.3.1(1)
- Acceptance Criteria: Same as 4.6.3.(1)
- Non-destructive Testing::
    - Radiographic examinations on 25 percent of all CJP welded butt splices from each production lot (150 splices max)
    - Engineer selects splices that comprise a lot as well as the sample splices within the lot.
    - Radiographic examinations are performed by the Contractor in conformance with AWS D1.4.
    - Before radiographic examination, welds must conform to Section 4.4, "Quality of Welds," of AWS D1.4.
    - If 12 percent of radiographically-examined splices are defective, an additional 25 percent of the splices, selected by the Engineer, from the same lot must be re-examined.
    - If more than 12 percent of the cumulative total of splices tested from the same production lot is defective, all of the remaining splices in the lot must be radiographically-examined.
    - All defects must be repaired in conformance with AWS D1.4.

The Contractor must give the RE written notice 48 hours before performing radiographic examinations.

4.6.3.2 Ultimate Splices

Ultimate splice locations are indicated on the plans. Typically used to splice reinforcement in seismic critical elements such as pile shafts and columns, ultimate splices can be resistance welded, mechanically coupled, or complete penetration welded. Hoops can have ultimate splices inside the "No-Splice Zone," but splices are not allowed in main column reinforcing steel inside the "No-splice Zone." Ultimate splice samples, which require a control bar in addition to the splice, are tested for ductility as well as tension.

4.6.3.2(1) Resistance Weld

- Pre-qualification: See 4.6.2
- QC sampling (Production Test Requirements):
  - QCM notifies RE in writing when splices in a lot have been completed (and epoxy-coated if required) and are ready for testing.
  - The Engineer or Engineer's representative randomly selects four samples and places tamper-proof markings or seals on them. Splices on straight bars are sampled at the job site. Hoops can be sampled either at the fabrication facility or at the job site.
  - The Contractor selects the adjacent control bar for each splice. The Engineer places tamper-proof markings or seals on them.
  - If a tamper-proof marking or seal is disturbed prior to testing, the sample can be rejected.
  - Sample four splices from every lot of production splices and four control bars.
  - Samples should be 1.5-m long for #25 and smaller, and 2-m long for #29 and larger.
  - Length of control bar: 1.0m for #25 and smaller and 1.5m for #29 and larger.
  - Securely bundle sample splices and control bars together.
  - Contractor identifies the samples as "Production Ultimate" and fills out the TL-0101 before shipping.
  - Send samples to the independent testing lab.
- QA sampling (Quality Assurance Test Requirements) is the same for QC sampling, except:
  - The first, and at least one randomly selected of the next five, lot of production splices is sampled and tested.
  - QA Inspector randomly selects the eight samples (four to the independent lab and four to Translab) and contractor prepares the corresponding eight control bars.
  - Contractor identifies the samples as "QA Ultimate" and fills out the TL-0101 before shipping.
  - QA samples are sent to Translab
- Test Requirements:
  - Contractor notifies Engineer at least one week prior to testing.
  - Tensile requirement: minimum tensile strength of not less than 550 MPa.
  - Ductility requirement: rupture outside the affected zone or if within rupture zone, splice achieves at least 95 percent of the ultimate tensile strength of the associated control bar. In addition, **necking** of the bar shall be visible at rupture, regardless of where the rupture occurs.
- Acceptance Criteria:
  - Test splices for tensile strength

        - If at least three splices pass the tensile requirement, the lot is acceptable.
        - If only one sample passes, the lot is rejected.
        - If only two samples pass, retest four additional splices from the same lot. If all four pass, the lot is acceptable. If any one fails, the lot is rejected.
    - Test splices for ductility
        - If at least three splices pass, lot is acceptable
        - If only one sample passes, the lot is rejected.
        - If only two samples pass, retest four additional splices from the same lot. If all four pass, the lot is acceptable. If any one fails, the lot is rejected.
    - Test control bars for ultimate tensile strength
        - Tensile test control bars to rupture. If two control bars are tested for one sample splice, the bar with the lower ultimate tensile strength shall be considered the control bar.

4.6.3.2(2) Mechanical

- Pre-qualification: See 4.6.2
- QC sampling: Same as 4.6.3.2(1)
- QA sampling : Same as 4.6.3.2(1)
- Test Requirements:
    - Contractor notifies Engineer at least one week prior to testing.
    - **Slip requirement:** Dependent upon bar diameter- see table in 52-1.08B(1). Only applies to mechanical butt splices on straight bars (no hoops).
    - Tensile Requirement: Minimum tensile strength of not less than the lower ultimate tensile strength of the two control bars; in any case not less than 550MPa
    - Ductility requirement: rupture outside the affected zone or if within affected zone, splice achieves at least 95 percent of the ultimate tensile strength of the associated control bar. In addition, necking of the bar shall be visible at rupture, regardless of where the rupture occurs.
- Acceptance Criteria:
    - Test splices for slip
        - Test one splice for slip.
        - If this splice fails the slip requirement, test remaining three for slip. If any of the three fail, the entire lot is rejected.
        - If remaining three pass, test splices for tensile strength.
    - Test splices for tensile strength.
        - If at least three splices pass the tensile requirement, the lot is acceptable.
        - If only one sample passes, the lot is rejected.

- If only two samples pass, retest four additional splices from the same lot. If all four pass, the lot is acceptable. If any one fails, the lot is rejected.
- Test splices for ductility:
  - If at least three splices pass, lot is acceptable.
  - If only one sample passes, the lot is rejected.
  - If only two samples pass, retest four additional splices from the same lot. If all four pass, the lot is acceptable. If any one fails, the lot is reject
  - If this splice fails the slip requirement, test remaining three for slip. If any of the three fail, the entire lot is rejected.
- Test control bars for ultimate tensile strength
  - Tensile test control bars to rupture. If two control bars are tested for one sample splice, the bar with the lower ultimate tensile strength shall be considered the control bar.

4.6.3.2(3) Complete Joint Penetration Weld

- Pre-qualification:
  - Welder and welding procedure must be qualified per AWS D1.4.
  - Check for SPR approval.
- QC sampling: Same as 4.6.3.2(1)
- QA sampling: Same as 4.6.3.2(1)
- Test Requirements: Same as 4.6.3.2(1)
- Acceptance Criteria: Same as 4.6.3.2(1)
- Non-destructive Testing:
  - Radiographic examinations on 25 percent of all CJP welded butt splices from each production lot (150 splices max)
  - Engineer selects splices that comprise a lot as well as the sample splices within the lot.
  - Radiographic examinations are performed by the Contractor in conformance with AWS D1.4.
  - Before radiographic examination, welds must conform to Section 4.4, “Quality of Welds,” of AWS D1.4.
  - If 12 percent of radiographically-examined splices are defective, an additional 25 percent of the splices, selected by the Engineer, from the same lot must be re-examined.
  - If more than 12 percent of the cumulative total of splices tested from the same production lot is defective, all of the remaining splices in the lot must be radiographically-examined.
  - All defects must be repaired in conformance with AWS D1.4.
  - The Contractor must give the RE written notice 48 hours before performing radiographic examinations.

4.6.4 Reporting

The independent testing lab prepares the Production Test Report (PTR) for all QC testing performed on each lot of splices. The PTR is submitted to the QCM for review and approval. The PTR is signed by the lab's representative, who is a Civil Engineer registered in the State of California. The PTR contains the following information for each test:

- Contract number
- Bridge number
- Lot number and location
- Bar size
- Type of splice
- Length of mechanical splice
- Length of test specimen
- Physical condition of test sample splice and any associated control bar
- Any notable defects
- Total measured slip
- Ultimate tensile strength of each splice
- For ultimate butt splices
  - Limits of affected zone
  - Location of visible necking area
  - Ultimate tensile strength and 95 percent of this ultimate tensile strength for each control bar
  - A comparison between 95 percent of the ultimate tensile strength of each control bar and the ultimate tensile strength of its associated splice

Before the splices represented by the PTR are encased in concrete, the QCM must review, approve and forward each report to the RE. The RE has three working days to review each PTR and respond in writing.

Quality Assurance Staff must ensure that Quality Assurance test results for each bundle of splices are reported to the Contractor within three working days after the Translab receives the bundle. If more than one bundle arrives at the Translab in one day, two additional days are allowed to provide results for each additional bundle received. QA test results will be provided for each bundle tested. QA Inspectors will not release any bundle of splices unless all QA test results are acceptable and other QC documents have been submitted and accepted by the RE as per the specification requirements.

4.6.5 Applicable Specifications

CJP Welded Splice:

- Std Spec 52-1.08B(2)
- Std Spec 52-1.08C
- AWS D1.4

Resistance Welded Service Splice:

- Std Spec 52-1.08B(3)
- Std Spec 52-1.08C

Mechanical Service Splice:

- CT 670
- Std Spec 52-1.08B(1)
- Std Spec 52-1.08C

Resistance Welded Ultimate Splice:

- CT 670
- Std Spec 52-1.08B(3)
- Std Spec 52-1.08C

Mechanical Ultimate Splice:

- CT 670
- Std Spec 52-1.08B(1)
- Std Spec 52-1.08C

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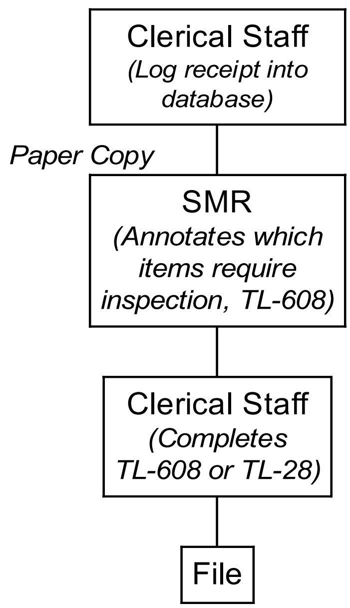
Appendix A – Administrative Procedures

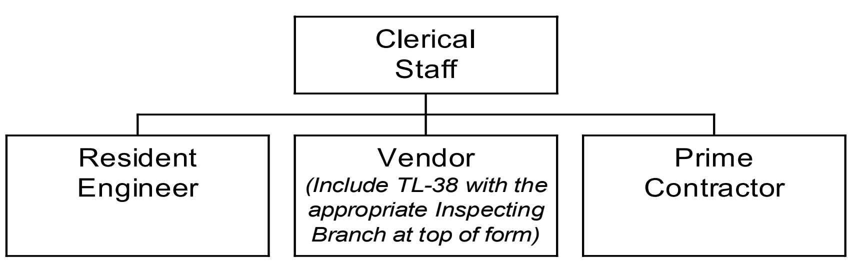
Notification of DC-CEM-3101

Inspection should occur within
48 hours of receipt of request.



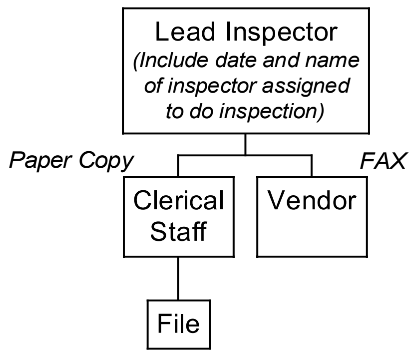
Written Notification of TL-28 and TL-608

Entire process shall be complete
within 72 hours of receiving DC-CEM-3101.



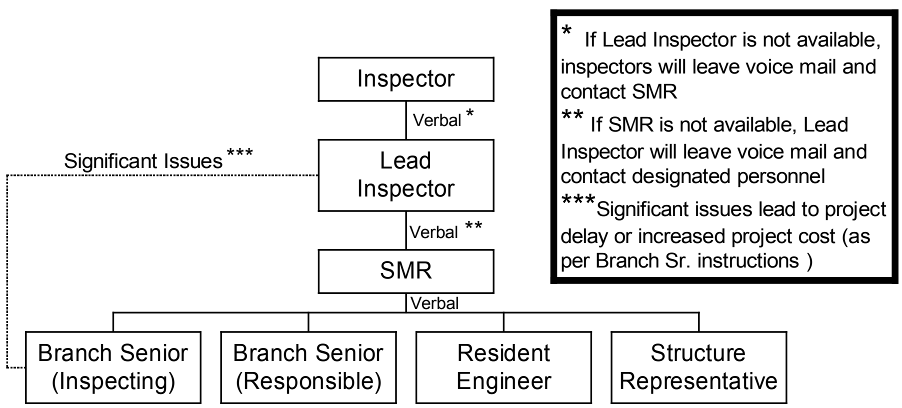
Notification of Inspection Request, TL-38

Inspection should occur within
48 hour of receipt of request.



Initial Verbal Notifications of NCRs

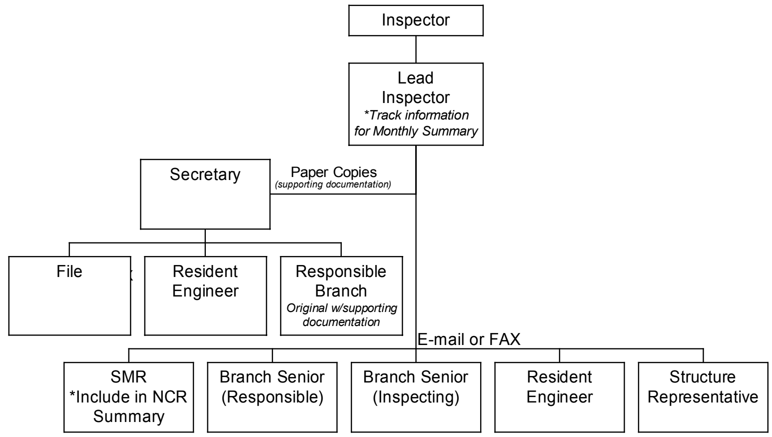
(TL -15, TL-24, and TL-26)
Process should be complete within 60 minutes of NCR



Written Notification of NCRs

(TL -15, TL-24, and TL-26)

Process should be complete within 1 Business Day of NCR



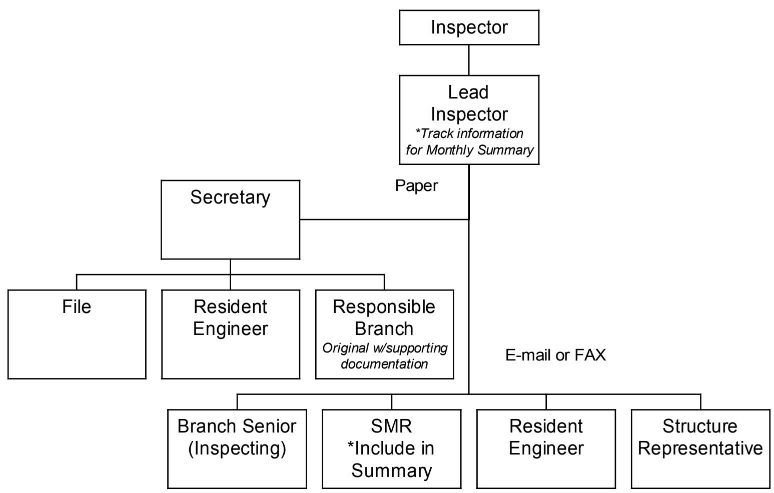
Written Notification of OSM Reports

(TL - 29, TL-6011, and TL-603x)

(TL-23, 25, & 27)

Inspector's report shall be complete within 24 hours.

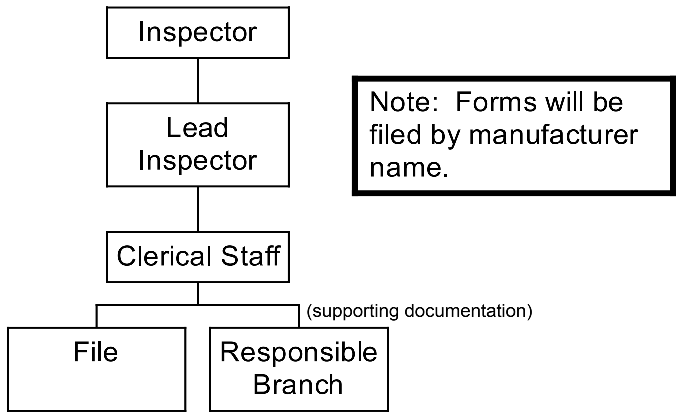
Entire process shall be complete within 72 hours.



Written Notification of OSM Reports

(TL-6012)

Inspector's report shall be complete within 24 hours.
Entire process shall be complete withing 72 hours.



Contract Award Summary

Sacramento:
Receive document

Enter EA in Database

Enter County, Route and PM in database

Enter work description in Database

er name, address, and phone # of Contractor in

Enter contract amount in abase

Fax copy to responsible Branch

Designated Branch inform District SMR

Create file folder

Special Provisions/Plans

Receive Plans and Special Provisions

File one set of plans and specials in Branch Library

Note: Non-responsible branches will maintain one set of Plans and Specials upon receipt.

HC-49: RE Assignment

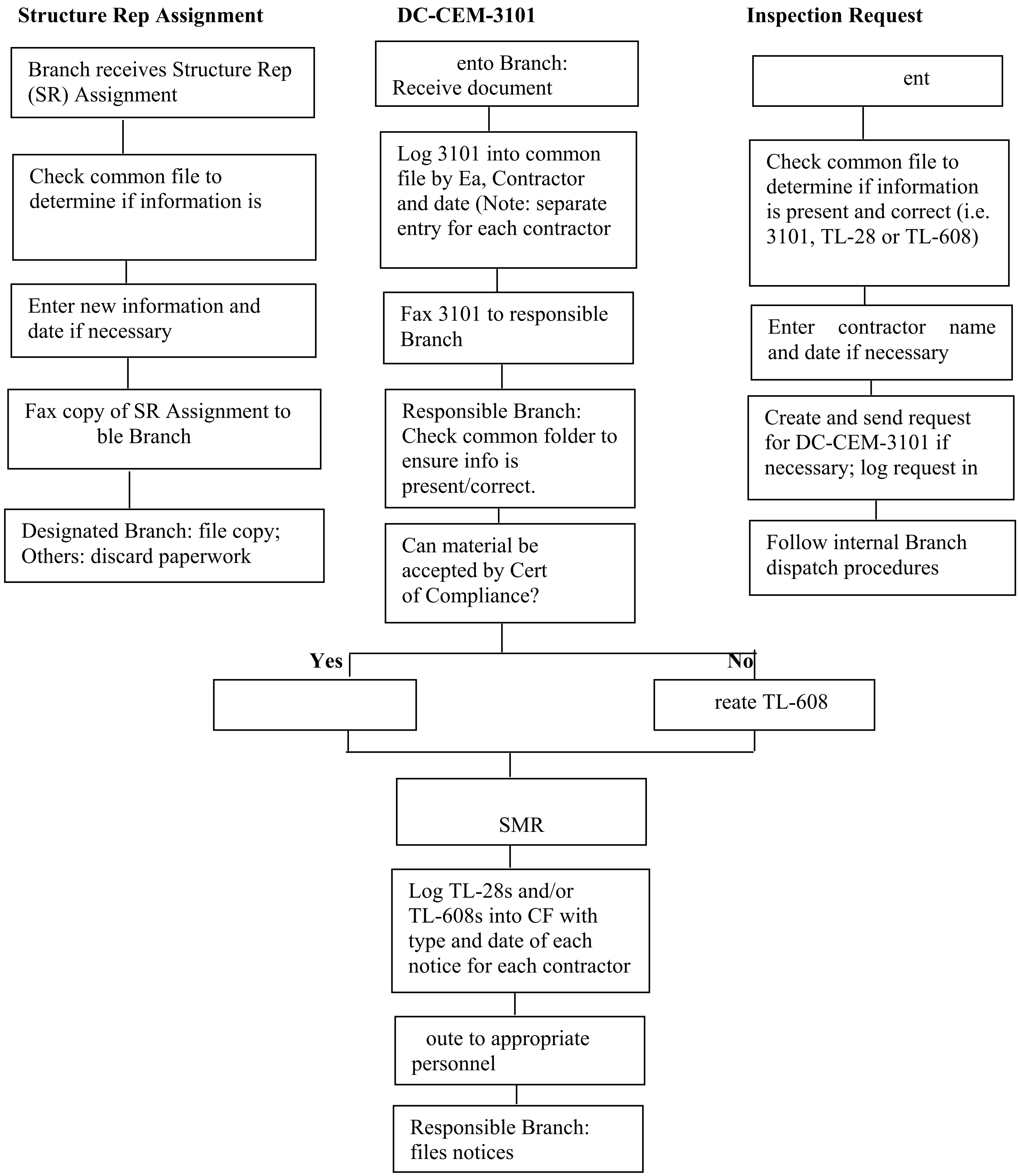
Branch receives HC-49

heck database to determine if information

Enter new information and date if necessary

Fax copy of HC-49 to responsible Branch

Responsible Branch file copy; Others, discard paperwork


Structure Rep Assignment
Branch receives Structure Rep (SR) Assignment
Check common file to determine if information is
Enter new information and date if necessary
Fax copy of SR Assignment to ble Branch
Designated Branch: file copy; Others: discard paperwork
DC-CEM-3101
ento Branch: Receive document
Log 3101 into common file by Ea, Contractor and date (Note: separate entry for each contractor
Fax 3101 to responsible Branch
Responsible Branch: Check common folder to ensure info is present/correct.
Can material be accepted by Cert of Compliance?
Yes
No
reate TL-608
SMR
Log TL-28s and/or TL-608s into CF with type and date of each notice for each contractor
oute to appropriate personnel
Responsible Branch: files notices
Inspection Request
ent
Check common file to determine if information is present and correct (i.e. 3101, TL-28 or TL-608)
Enter contractor name and date if necessary
Create and send request for DC-CEM-3101 if necessary; log request in
Follow internal Branch dispatch procedures

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Appendix B – Monthly Summary Report

Monthly Summary Report Definitions

1. Month – The month covered by the reporting period.
2. Number Of Workdays – This is the actual number of days worked in the calendar month. The number of days may differ between State and consultant staff.
3. Personnel Assigned
   a. State Inspectors – The number of state inspectors assigned to the branch. This number includes all full time assignments, inspectors on sick leave, or inspectors on vacation. This number may not be a whole number if the inspector was not assigned to the branch for the full amount of working days. For example: Inspector X worked for the LA branch for 15 days and the Bay Area Branch for 7 days. Assuming 22 workdays in the month, LA would count this as 15/22 = 0.68 inspector and the Bay Area would count the inspector as 0.32 inspector.
   b. Consultant Inspectors - The number of consultant inspectors assigned that are available for assignment. This number does not differentiate between Law, Kleinfelder, Twinning, etc. This number may not be a whole number if the inspector was not assigned to the branch for the full amount of working days. See above for example.
   c. All Others – This includes all other office personnel within the branch location to include SMRs, Admin, Task Leaders, Area Manager, Branch Senior, or any personnel permanently assigned to the office who are not specifically inspectors. This number may not be a whole number if the personnel were not assigned to the branch for the full amount of working days. For example: an administrative assistant started work at the end of the month and only worked 3 days out of 22 working days. This person would count as 3/22 or .14 in this category. NOTE: On page 2 of the report, the number of days worked must be the same as the number of days annotated in the "Days Assigned" column.
4. Hours Worked
   a. State – The total number of hours worked by the state inspectors only as determined during the month specified in block 1.
   b. Consultant – The total number of hours worked by the consultant inspectors only as determined during the month specified in block 1.
   c. Total – Sum of the hours worked by State and Consultant Inspectors only.
5. Daily Average
   a. State – Number of state hours worked/(Number of state inspectors * Number of work days for state employees)
   b. Consultant - Number of consultant hours worked/(Number of consultant inspectors * number of work days by consultant inspectors)
   c. Total – $\dfrac{\text{Total hours worked}}{(\text{\# state inspectors* state workdays}) + (\text{\# consultant inspectors*consultant workdays})}$
6. Inspection Request – The total number of inspection requests sent to an office. This does <u>NOT</u> include requests sent in by locations where an inspector is assigned full time as annotated on page 2 of this report. This number includes calls that are both answered and cannot be answered due to personnel shortages. For example, due to competing demands, calls are triaged due to importance. The calls not responded to will be incorporated in this number. This category does <u>NOT</u> include inspection requests that are rejected because the material is not inspected by OSM. A TL-28 should be sent out for these items.

7. Inspection Calls – The total number of requests answered by the inspectors during the rated month. This does not include inspection calls for locations where an inspector is assigned full time.
8. Inspection Calls > 48 hrs – This is the number of inspection requests that could not be completed within 48 hours or 2 working days of receiving the request. For example, if a request was received on Monday, the inspection would need to be completed by Wednesday in order for it not to be counted in this category. Inspection Requests in which the date requested is further out than 48 hours or 2 working days will not be counted in this category.

9. Branch Ratio – This ratio accounts for the average number of inspection calls an inspector can accomplish in one day. This number is different for branches due to driving distances and number of calls that can be accomplished in single locations. This number will continue to be refined over time as historical data is developed.
10. FTA Equivalents – **Automatically calculated**

$$\frac{\textit{Inspection Calls}}{\textit{Branch Ratio x Working Days}}$$

k. NOTE: This is for information only. This is the theoretical number of inspectors that should be available to respond to inspection requests.

11. Actual Ratio – **Automatically calculated**

$$\frac{\textit{Inspection Calls}}{\textit{(Total Personnel Assigned – FTAs) x Working Days}}$$

12. FTAs – **Automatically calculated**

$$\frac{\textit{Sum of Days Assigned for Personnel list as a FTA}}{\textit{Working Days}}$$

13. BUR – **Automatically calculated**:

$$\frac{\textit{Inspection Request}}{\textit{Branch Ratio (Total Inspectors – FTAs) x Working Days}}$$

14. On Going Projects – This is the current number of on-going projects in the area of responsibility of each branch. This includes all state projects as well as any local project in which OSM may have involvement..
15. # w/ OSM Involvement – This is the number of projects in which some amount of QA inspection by METS is required.
16. 3101s Received/TL608s/TL28. These are based upon actual data. This is the number of 3101s received and does NOT include individual items.
17. Total – This is the sum of all TL-28s and TL-608s sent out. The number of TL608s and TL28s sent out may be much higher than the actual number of 3101s received due to multiple items listed on a single 3101.
18. Reports Completed
    a. Material Releases (TL-29s and TL-6011s)/NCRs/QCP Reviews/QA Lead Verifications are all based upon actual data.
        i. QCP Reviews include all addendums, drawings, RFIs, and reviews handled by the lead inspector/task leader.

b. NCRs – This number is based upon only the NCRs issued during this month and does not incorporate the number resolved during this month or previous months.

c. Types of Inspection Reports

    i. Welding – These reports include only welding inspection reports. Welding witness reports are NOT included in this category.

    i. Concrete/Source reports are based upon actual data.

    ii. Total – Sum of all reports.

d. Material On-hand Reports – This is the total number of Material On-Hand reports completed by the Branch for the month.

e. Welding Witness Reports - This is the total number of Welding Witness reports completed by the Branch for the month.

f. QCP Reviews - This is the total number of Welding or Concrete Quality Control Plan Reviews completed by the Branch for the month.

g. QA Lead Verifications – This is the total number of QA Lead Verifications performed in the Branch for the month.

19. Outstanding NCRs – This number is based upon actual data and should reflect the actual number listed in the NCR Summary Report.

20. Monthly Summary Report – 2nd Page –

a. Include Branch Senior. Days assigned should equal working days described above in #2.

b. Include Clerical Staff. Day assigned should equal number of working days described above in #2. If staff just started the job, ensure days assigned coincide with fraction placed in "All Others" (see #3.c. above).

c. Include SMRs. Days assigned should equal number of working days described above in #2. If staff just started the job, ensure days assigned coincide with fraction placed in "All Others" (see #3.c. above).

d. Include Lead Inspectors or Task Leaders. Include only the number of days the Lead Inspector did not perform any inspection calls. (QA Lead Verifications do not count as an inspection call).

e. Include all full time assignments.

A full time assignment is considered a site that, by contract documents, requires the assignment of inspector to be on site every day. Inspection requests and Inspection calls from facilities or sites with an inspector assigned full time do not count towards the total discussed above.

f. Include any and all vacation days taken by personnel (excluding holidays).

g. Include all sick days or disability leaves.

h. Include any personnel attached to a project from another Law Organization to reflect demand on office that was addressed with outside support. NOTE: This person must be include in #3.b. above with the corresponding fraction of days assigned to total working days.

i. Include any other personnel counted in #3 above that are not available to perform inspections should also be included.

j. Include any sites or locations that contract documents require personnel on a permanent basis as determined by the Branch Senior.

k. Include the number of state employees for each day (holiday) in which state employees did not work and consultants did.

MONTHLY SUMMARY REPORT

Month:	December	**Number of Workdays:**			
		State:			
		Consultant:			
Inspectors Assigned:		**Hours Worked:**		**Daily Avg.**	
State Inspectors:		State:		#DIV/0!	
Consultant Inspectors:		Consultant:		#DIV/0!	
All others:		Total:	0	#DIV/0!	
Total:	0				
Inspection Requests:		Actual Ratio:	#DIV/0!		
Inspection Calls:		**Personnel Unavailable to Perform Inspections:**	0.00		
Inspection Calls > 48 hrs:					
Branch Ratio:	2.5				
Est. Insps Req'd for Calls:	#DIV/0!				

BUR: #DIV/0!

Branch Ratios	
Sacramento:	2
Bay Area:	5.5
Los Angeles:	2.5

On Going Projects:		
# w/ OSM involvement:		#DIV/0!
# 3101s Received:		
# TL-608's Sent Out:		#DIV/0!
# TL-28's Sent Out:		#DIV/0!
Total:	0	
Reports Completed:	0	**%**
Material Release:		#DIV/0!
NCRs:		#DIV/0!
Inspection Reports:	0	#DIV/0!
Material On-Hand Reports:		#DIV/0!
Welding Witness Reports:		#DIV/0!
QCP Reviews:		#DIV/0!
QA Lead Verification		#DIV/0!
Outstanding NCRs:		

Type of Inspection Reports	
Welding:	
Concrete:	
Source:	
Total:	0

MONTHLY SUMMARY REPORT

(Page 2 of 2)

Name	Location or Position		Days Unavailable
	Branch Senior		
	Area Manager		
	Structural Mat'ls Rep		
	Structural Mat'ls Rep		
	Structural Mat'ls Rep		
	Structural Mat'ls Rep		
	Structural Mat'ls Rep		
	Structural Mat'ls Rep		
	Structural Mat'ls Rep		
	Lead Inspector		
	Lead Inspector		
	Lead Inspector		
	Lead Inspector		
	Lead Inspector		
	Lead Inspector		
	Total Vacation Days		
	Total Sick Days		

Total Number of Personnel Unavailable to Perform Inspections: #REF!

Appendix C – OSM Standard Forms

http://www.dot.ca.gov/hq/esc/Translab/smbforms.htm

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Appendix D - Sign Structure, Signal, and Lighting Pole Procedures

Memorandum

Flex your power!
Be energy efficient!

To: RESIDENT ENGINEER and/or
Structure Representative
For project XX-XXXXXX with CMS or Overhead

Date: Month day, year

File: [Signs Overhead-General]

From: **NAME** (all Caps Bold)
Title
Functional Area (Division/Office)

Subject: Identification of Overhead Sign Structures in Bid Items

The Office of Structural Materials (OSM) of Materials Engineering and Testing Services (METS) is available to assist you with quality assurance and source inspections of changeable message and overhead sign structures for your project. Your primary point of contact for this and other structural material related issues is the Structural Materials Representative for District XX. The SMR for District XX is (Name of SMR) and can be reached at (XXX) XXX-XXXX. Our records indicate that XXXXX CMS and XXXXXX overhead sign structures are specified for your project. The following procedures have been established to ensure the State receives a high quality product from sign manufacturers.

1. Verify that a notice of material to be used, form CEM-3101 (formerly HC-30), is submitted to OSM Headquarters in Sacramento (see distribution on form CEM-3101) for the CMS and/or overhead sign structures on your project. It is critical that a CEM-3101 is received. This gives our office the information necessary to arrange for travel and provide source inspection to the designated fabricator.
2. Per Section 8-3 of your project's Special Provisions, a pre-welding meeting is required before any Welding Quality Control Plan submittal. Please notify the SMR when this meeting occurs. It is recommended that a representative from OSM also attend these meetings to ensure potential problems are addressed early in the project.
3. Ensure the appropriate OSM office receives a copy of the submitted WQCP.
   OSM is here to assist you with the review of the WQCP submittal and make a recommendation on whether it should be accepted or not. When your office

submitted to the <Double Click to Select Branch> Quality Assurance and Source Inspection Branch located at <Double Click to Select Address>. Please address these to the attention of the appropriate SMR. OSM will need approved shop plans to verify the product complies with contract documents during inspection.

Inspection procedures require that all four items must be complete in order for OSM to inspect and release any portion of the CMS and/or overhead sign structure to the job site. If any of the four items are deficient, our inspectors will document all source inspection activity on the Source Inspection Report, form TL-6034, for your records.

We are eager to assist you in any way possible in the resolution of these or other materials engineering problems. If you have any further questions, please do not hesitate to contact the Structural Materials Representative for District XX, (SMR name) (XXX) XXX-XXXX.

c. SMR – METS

PLEASE NOTE: The signature block is no longer to be used as such at the end of memos: the writer is to initial after his/her name on the “From” line. There is no mail station number included.

DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
MATERIALS ENGINEERING AND TESTING SERVICES
5900 FOLSOM BOULEVARD
SACRAMENTO, CA 95819-4612
PHONE (916) 227-7254
FAX (916) 227-5295
TTY (916) 653-4086

Flex your power!
Be energy efficient!

Date

Sierra Nevada
3095 Beacon Way
West Sacramento, CA 95821

To whom it May Concern:

The Office of Structural Materials (OSM) of Materials Engineering and Testing Services (METS) has received a Notice of Materials to be Used, CEM-3101 (formerly HC-30) that identifies you as the fabricator for a CMS and/or overhead sign structure. Per the contract documents, OSM is planning on inspecting an estimated quantity of XXXXX KG of tubular sign structure(s), XXXX KG of lightweight sign structure(s), XXXX KG of truss sign structure(s), and XXXX KG of CMS(s).

Current California Department of Transportation procedures require that OSM inspect and release all sign structures at the source of manufacture. Please be aware that we must receive an Inspection Request Form, TL-38, in order for an inspection to be scheduled. We request that you provide us at least one week's notice prior to any requested inspection date.

You are reminded that contract documents require the Resident Engineer conduct a pre-weld meeting with the Contractor and any entity performing welding prior to submittal of a Welding Quality Control Plan (WQCP). An OSM representative will be available at the meeting to address any questions you may have concerning the WQCP or the QA inspection process. OSM will not release any material without an approved copy of the WQCP and working drawings.

(Begin subsequent headers on fourth line)
ADDRESSEE
DATE
Page 2

OSM can better assist your facility during the source inspection process if the following items are complete:

1. A technical representative of your company is in attendance during the pre-welding meeting.
2. An RE approved copy of the WQCP is on site at the fabrication facility.
3. RE approved working drawings are available for our inspector's review at the fabrication facility. OSM requires approved working drawings to verify the product complies with contract documents during inspection.

If you have any questions or concerns, regarding inspection of CMS or overhead sign structures, please contact the Structural Materials Representative for District XX, (SMR name) (XXX) XXX-XXXX.

Sincerely,

XXXXXXXXXXXX, P.E., Chief
XXXXXXXXX Quality Assurance and Source Inspection Branch
Office of Structural Materials

Enclosures

c: SMR – METS
XXXXXX– RE
XXXXXX– SR (These names appear on the original letter and all copies of the original.)

Document Number (MTO or DOTS – hidden text)

M e m o r a n d u m

Flex your power! Be energy efficient!

To: RESIDENT ENGINEER
Structure Representative
For project XX-XXXXXX with CMS or Overhead

Date: Month,day,year

File: Signs-Overhead

From: **NAME (ALL CAPS) (NAME IN BOLD)**
Title
Functional Area (Division/Office)

Subject: Receipt of Inspection Request for Overhead Sign Structures

The Office of Structural Materials (OSM) of Materials Engineering and Testing Services (METS) has received notification that Overhead Sign Structures are being fabricated for your project. A review of our records indicate that we have not received a DC-CEM-3101, Notice of Materials to be Used, an approved copy of the Welding Quality Control Plan (WQCP), or approved shop plans. **{Edit for what items are actually missing}** Upon receipt of these items, OSM will schedule an inspection at the source of fabrication to determine if the material conforms to contract requirements.

The fabricator, XXXXXXXXX is aware that source inspection will occur at their facility. They have requested source inspection from this office. Inspection procedures require an approved WQCP and an approved set of shop plans before our inspectors can inspect and release sign structures. To better assist you, the following steps summarize the remaining QA inspection procedures for CMS and/or overhead sign structures:**{Edit below items if applicable}**

1. Per Section 8-3 of your projects Special Provisions, a pre-welding meeting is required before any Welding Quality Control Plan submittal. Please notify the designated SMR when this meeting occurs. I recommend that a representative from OSM be allowed to attend these meetings to assist you and ensure potential problems are addressed early in the project.
2. Ensure the appropriate OSM office receive a copy of the submitted WQCP. OSM will assist you with the review of the WQCP submittal and make a recommendation on whether it should be accepted or not.

Please notify when you have given the contractor a notice of final acceptance for the WQCP.

3. After the shop plans are reviewed and approved for the sign structures on your project, a copy of the approved drawings should be submitted to the XXXXXX OSM branch office, ATTN: SMR, Street Address, City, State, ZIP. OSM requires approved shop plans to verify the product complies with contract documents during inspection.

Inspection procedures require that all three items must be complete in order for OSM to inspect and release any portion of the CMS and/or overhead sign structure to the job site. If any of the three items are deficient, our inspectors will document all source inspection activity on the Source Inspection Report, form TL-6034, for your records.

We are eager to assist you in any way possible in the resolution of these or other materials engineering problems. If you have any further questions, please do not hesitate to contact the Structural Materials Representative for District XX, (SMR name) (XXX) XXX-XXXX.

c: SMR – METS

PLEASE NOTE: The signature block is no longer to be used as such at the end of memos: the writer is to initial after his/her name on the "From" line. There is no mail station number included.

App D-3	Shop Plans	Pre-weld	WQCP Rec	WQCP App	TAG?	TL-29 Q	% Insp	Comments
	4/22/2002	4/12/2002	5/13/2002	5/16/2002	Yes	3000	50%	
	4/22/2002		3/12/2002	3/13/2002	Yes	AB	#VALUE!	WQCP submittal, occurred before policy change.
		4/12/2002					0%	
							0%	
							0%	
							0%	need to send form letter
							0%	
					Yes	1	33%	This is a Sign Struct reloca that may require a METS inspector afterwards
							#DIV/0!	
							#DIV/0!	
							#DIV/0!	
							#DIV/0!	
							#DIV/0!	
							#DIV/0!	
							#DIV/0!	
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Appendix E

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Appendix F – Manufacturing and Fabrication Qualification Audit

http://www.dot.ca.gov/hq/esc/Translab/smbpubs.htm

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Appendix G –Project Closeouts

G-1 Project Closeout Checklist

EA:________________________ D-Cty-Rte-PM: __________________ Phase:_______

Project Completion Date: ________________________ Accepted: Yes/No

RE Contact Info: ____
____
____

Action	Action Complete	Comments
Contract file in branch moved to closure area?		Strip duplicate records
E-mail EA# to other branch area managers?		They destroy their specials and drawings.
All OSM info collated?	LA – SAC – BA	Need all files.
Inspectable Bid Items?		Attach list
NCRs all resolved		If no-ltr 1-send records to RE
All items inspected? 608's/28's?		If no-ltr 2-send records to RE
All inspections/NCR/claims resolved		Letter 3 – send records to RE
Send all records to RE – dispose of dwgs and specials!!!		

G-2 Unresolved NCR's

To: <<NAME, title>>
<<address>>
<<address>>

Date: <<date>>

File: <<project EA>>
<<project name>>

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
MATERIALS ENGINEERING AND TESTING SERVICES

Subject: Unresolved Non-Conformance Reports

l. The subject project has been closed with unresolved non-conformance reports on the following items:

m. 1. <<describe NCR here>>

n. 2. <<continue list as necessary>>

o. As this project has been accepted by you, METS/OSM is assuming that you consider these NCR's resolved and we will consider this letter as resolution of the NCR's on our behalf.

p. All applicable METS documentation for this project has been attached to this letter for your use. Please use the documents that you require for the project history file and archives.

q. It is important to note that QA verification does not relieve the contractor of the obligation to provide materials that are in compliance with all contract plans and specifications.

r. If you have any questions or would like to discuss the issues, please call **<<include your name and phone number>>**.

KEITH HOFFMAN, Chief
Emeryville Quality Assurance
and Source Inspection Branch

Attachment: METS Contract Documents

G-3 – QA Incomplete

To: <<NAME, RE>>
<<address>>
<<address>>

Date: <<date>>

File: <<project EA>>
<<project name>>

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
MATERIALS ENGINEERING AND TESTING SERVICES

Subject: Non-Verified Materials

a. The following items did not receive QA verification by METS prior to acceptance of the project:

b. 1. <<list item>>

c. 2. <<continue list as necessary>>

d. As this project has been accepted by you, METS/OSM is assuming that you received adequate documentation from the contractor and are satisfied with the quality of the materials listed.

e. All applicable METS documentation for this project has been attached to this letter for your use. Please use the documents that you require for the project history file and archives.

f. It is important to note that QA verification does not relieve the contractor of the obligation to provide materials that are in compliance with all contract plans and specifications.

g. If you have any questions or would like to discuss the issues, please call **<<include your name and phone number>>**.

KEITH HOFFMAN, Chief
Emeryville Quality Assurance
and Source Inspection Branch

Attachment: METS Contract Documents

G-4 – No Outstanding Issues

To: <<NAME, RE>>
<<address>>
<<address>>

Date: <<date>>

File: <<project EA>>
<<project name>>

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
MATERIALS ENGINEERING AND TESTING SERVICES

Subject: Quality Assurance Project Close-out

a. The subject project has been closed and accepted. All materials that required QA were verified by a METS inspector.

b. All applicable METS documentation for this project has been attached to this letter for your use. Please use the documents that you require for the project history file and archives.

c. It is important to note that QA verification does not relieve the contractor of the obligation to provide materials that are in compliance with all contract plans and specifications.

d. If you have any questions or would like to discuss the issues, please call **<<include your name and phone number>>**.

KEITH HOFFMAN, Chief
Emeryville Quality Assurance
and Source Inspection Branch

Attachment: METS Contract Documents

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Appendix H –Concrete Reference Materials

METS PRECAST PLANT
SUPPLEMENTAL "PRE-FABRICATION" CHECKLIST

Contract No: ______________________________ Date: ______________________________

MIX DESIGN REVIEW PROCEDURES

Yes	No		Yes	No	
☐	☐	Gradation Report	☐	☐	Combined Aggregate Testing
☐	☐	Coarse Aggregate Testing	☐	☐	Cement
☐	☐	Fine Aggregate Testing	☐	☐	Concrete
☐	☐	Additional tests for lightweight concrete			

Comment: ____

QUALITY CONTROL PERSONNEL

QC Manager	☐PE	☐PCI, Level ___	☐IA
QC Inspector	☐PE	☐PCI, Level ___	☐IA
QC Technician	☐PE	☐PCI, Level ___	☐IA

Comment: ____

NOTE:
Obtain any QC documentations and certifications, along with organization and quality control training program.

EQUIPMENT CALIBRATION

Yes	No			
☐	☐	Batch Plant CT-109	*Serial #* ___________	*Date* __/__/___
☐	☐	Batch Reports (Manual/Computer	*Serial #* ___________	*Date* __/__/___
☐	☐	Hydraulics Rams	*Serial #* ___________	*Date* __/__/___
☐	☐	Hydraulic Jack Curves	*Serial#* ___________	*Date* __/__/___
☐	☐	Lab Certification		*Date* __/__/___
☐	☐	Gauges (Single or Multiple)	*Serial #*___________	*Date* __/__/___
☐	☐	Compressive Strength Machine	*Serial #* __________	*Date* __/__/___
☐	☐	Was Compressive Strength Machine checked for Loading Rate?		
☐	☐	Steam Clocks (Accuracy)	*Serial #* __________	*Date* __/__/___

Contract No: ____________________ Date: ____________________

REINFORCEMENT
Epoxy coated, Uncoated, Zinc

Yes	No	N/A		Yes	No	N/A	
☐	☐	☐	Green Tagged	☐	☐	☐	Correct Diameter
☐	☐	☐	Mill Certification	☐	☐	☐	Correct Length
☐	☐	☐	Certificate of Compliance (CC)	☐	☐	☐	Correct Spacing (Sec 52-1.07)
☐	☐	☐	Grade & Mill Certification match rebar being used in the field?				
☐	☐	☐	Correct Lapped Splice (Sec 52-1.08A)	☐	☐	☐	Stagger Splice (Sec 52-1.08)
☐	☐	☐	Butt Welded Splices Req'd? (Sec 52-1.08A)				
☐	☐	☐	Mechanical Butt Splices Req'd? (Sec 52-1.08C)				
☐	☐	☐	Coated tie-wire, if epoxy coated rebars are used				

Yes	No					
☐	☐	Epoxy-coated?	If Yes,	☐Gray	☐Purple	☐Green
☐	☐	Proper Storage	If No,	☐Rebar on Dunnage	☐Rebar on Ground	☐Rebar Covered
☐	☐	Damaged	If Yes	Did plant remove any damaged rebars?	☐Yes	☐No
☐	☐	Corrosion	If Yes,	☐Scattered	☐Shallow	☐Other______
☐	☐	Pitting	If Yes,	☐Scattered	☐Shallow	☐Other______
☐	☐	Rebar free of oil, dir, excessive miss scale, scabby rust, and other containments?				I
☐	☐	**DID QC VERIFY CAGE DIMENSIONS?**				

Comments: ____________________

NOTE:
If epoxy-coated, plant must have repair procedure if rebar is damaged

INSERTS

Types

Harps	☐Green-tagged	☐Mill Certification	☐COC
Bolts/Nuts/Washers	☐Green-tagged	☐Mill Certification	☐COC
Steel Plates	☐Green tagged	☐Mill Certification	☐COC
Imbeds	☐Green tagged	☐Mill Certification	☐COC
High-Strength Rods	☐Green tagged	☐Mill Certification	☐COC

Comments ____________________

DUCTS

Yes	**No**	
☐	☐	Is the duct free from damage or holes?
☐	☐	Using approved shop drawings, is the duct profile correct? (Eyeball it for a smooth profile)
☐	☐	Are the ducts properly sealed?
☐	☐	Are the duct splices staggered?
☐	☐	Are the ducts securely fastened in place?
☐	☐	Is the duct perpendicular to the anchor plate?

Comments: ____________________

METS PRECAST PLANT
SUPPLEMENT *"PRE-POUR" CHECKLIST – Page 2 of 2*

PRESTRESSING TENDONS	**Uncoated**	**Coated**

Yes No

☐ ☐ Orange Tagged
☐ ☐ Mill Certification
☐ ☐ Certificate of Compliance
☐ ☐ Grade and Mill Certification match rebar being used in the field.
☐ ☐ Are strands reels calwraped?
If Yes, Calwrapped in Good Condition? ☐Yes ☐No
☐ ☐ Proper Storage If No, ☐ Strand on ground ☐ Strand Covered ☐Other _________
☐ ☐ Damage If Yes, Did plant remove any damaged strands? ☐ Yes ☐No
☐ ☐ Corrosion If Yes, ☐Scattered ☐Shallow ☐Isolated
☐ ☐ Pitting If Yes, ☐Scattered ☐Shallow ☐Isolated
☐ ☐ Strand free of oil, dirt, excessive miss scale, scabby rust, and other containments?

Comments: ____

TENDON PLACEMENT & STRESSING

Rebar Placement – Coated/Uncoated (circle one)

Yes No

☐ ☐ Stressing Calculations TransLab Test Results: A&E Values: ____________________
☐ ☐ Correct Diameter
☐ ☐ Correct Number of Strands
☐ ☐ Debonds Required?
☐ ☐ Are strands in the casting beds straight (not crossing over each other)?
☐ ☐ **QC PRESENT at TIME of STRESSING?**
☐ ☐ Is Plant using two-pressure gauge system (One pressure gauge and one load cell gauge?)
☐ ☐ If epoxy-coated strands are used, were strand nicked/damaged during stressing:
If Yes, Did Plant remove any damaged strands? ☐Yes ☐No
☐ ☐ Did strands seat properly when initial stress was pulled? Initial Force, P_{ji} =_______________
☐ ☐ Any strand slippage measured during final stressing? Final Force, P_{jf} =_______________
☐ ☐ Elongations within tolerance range Tolerance Range =_______________
If No Did QC make proper adjustments ☐Yes ☐No

Comments: ____

NOTE:
"Lift-Off" required for strands stressed longer than three hours prior to concrete placement!

FORMS

Yes No

☐ ☐ Dimensions (length, height, width, etc.) in conformance with Shop Drawings
☐ ☐ Are forms clean and free of loose materials?
☐ ☐ Are forms tight to prevent leakages when closed?
☐ ☐ Are forms adjusted for camber?

Comments: ____

METS PRECAST PLANT
SUPPLEMENT "POUR" CHECKLIST

Contract No: ______________________________ Date: ______________________________

CONCRETE VERIFICATIONS

Yes	No	
☐	☐	Do batch weights match mix design?
☐	☐	Are Sampling and Testing Personnel properly certified? *Refer to* "Pre-Fabrication" checklist.
☐	☐	Any unusual circumstances or problems accrue during this inspection?

Comments: ____

CONCRETE PLACEMENT

Batch Plant Operator: ______________

Yes	**No**	
☐	☐	**QC PRESENT at TIME of CONCRETE PLACEMENT?**
☐	☐	Batch Plant Onsite
		If No, Is MR-0543 attached to each load batch ☐**Yes** ☐**No**
☐	☐	Was temperature of the concrete when placed 25º above ambient temperature at stressing?
		If Yes, Did QC make proper adjustments ☐**Yes** ☐**No**
☐	☐	Were forms and rebars moistened per STD Specs?
☐	☐	Was vibration done with internal vibrator?
☐	☐	If epoxy coated rebars/strands were used, is vibrator covered to protect rebars?
☐	☐	Moistures taken before batching?
☐	☐	Scales zeroed between loads?
☐	☐	Admixtures metering devices operating properly?
☐	☐	Concrete temp within limits Min:___(ºF) Max___(ºF) Acceptable ☐**Yes** ☐**No**
		Actual concrete temp: ___(ºF)
☐	☐	Concrete within time limits Max: (90 minutes for transit mixer or 45 minutes non-agitating)

CONCRETE PLACEMENT (continued)

Yes	**No**					
☐	☐	Performed Gradation				
☐	☐	Performed Moisture				
☐	☐	Specs req'd Kelly-Ball/Slump	Measurement:__________	Acceptable	☐Yes	☐No
☐	☐	Specs req'd Air Content	Measurement__________	Acceptable	☐Yes	☐No
☐	☐	Specs req'd Unit Weight	Measurement__________	Required ______________		
☐	☐	Cylinders (conformed to CTM 540?)				

Comments: ____

CONCRETE CURING

Yes	**No**	
☐	☐	Concrete steam cured overnight? Temperature range from ____________º F to ___________º F.
☐	☐	Concrete water cured 5 to 7 days?
☐	☐	Was curing compound used?
☐	☐	Is the 4 hour preset time being violated?
☐	☐	Is the maximum temperature rise per hour being violated?
☐	☐	Has the maximum temperature been held to 65º Cat 150º F

Comments: ____

METS PRECAST PLANT
SUPPLEMENTAL *"POST-POUR" CHECKLIST – Page 1 of 2*

Contract No: ______________________________ Date: ______________________________

CYLINDERS & COMPRESSIVE STRENGTHS

Yes **No**
☐ ☐ Are cylinders taken from the bed stripped and stored promptly per CTM-540?

Type of Cylinder Breaks ☐Transfer ☐7-Day ☐14-Day ☐28-Day ☐Other

Required Compressive Strength *Refer to Concrete Mix Design*
Transfer: fci=___________ *28-Day fc=__________-*
Comments: ______________________________

CONCRETE CURING

Yes **No**
☐ ☐ Concrete steam cured overnight?
☐ ☐ Concrete water cured 5 to 7 days?
☐ ☐ Was curing compound used?
☐ ☐ Is the 4 hour preset time being violated
☐ ☐ Is the maximum temperature rise per hour being violated?
☐ ☐ Has the maximum temperature been held to 65ºC or 150ºF.
☐ ☐ Is curing tank or fog room in compliance? Curing tanks 73º ± 3º
Comments ______________________________

DE-TENSIONING

Yes **No**
☐ ☐ Did compressive strength test achieve the minimum psi requirement before de-tensioning?
☐ ☐ **QC PRESENT at TIME of DE-TENSIONING?**
☐ ☐ Is the de-tensioning uniform in procedure?
☐ ☐ Are improper shock loads being transmitted into the members?
☐ ☐ Zinc-primer coating applied on strands?
Comments ______________________________

POST-TENSIONING TENDONS

Strands – Coated or Uncoated (circle one)

Yes **No**
☐ ☐ Orange-Tagged
☐ ☐ Mill Certification
☐ ☐ Certificate of Compliance (COC)
☐ ☐ Grade and Mill Certification match rebar being used in the field?
☐ ☐ Are Strands reels calwraped?
If Yes, Calwrapped in Good Condition ☐Yes ☐No
☐ ☐ Proper Storage — If No, ☐Strand on the Ground ☐Strand Covered ☐Other_________
☐ ☐ Damage — If Yes, Did plant remove any damaged strands? ☐Yes ☐No
☐ ☐ Corrosion — If Yes, ☐Scattered ☐Shallow ☐Isolated
☐ ☐ Pitting — If Yes ☐Scattered ☐Shallow ☐Isolated
☐ ☐ Strand free of oil, dirt, excessive miss scale, scabby rust, and other containments?
Comments: ______________________________

METS PRECAST PLANT
SUPPLEMENTAL *"POST-POUR" CHECKLIST- Page 2 of 2*

TENDON PLACEMENT & STRESSING

Rebar Placement – Coated or Uncoated (circle one)

Yes No

☐ ☐ Stressing Calculations TransLab Test Results: A&E Values: ____________________
☐ ☐ Correct Diameter
☐ ☐ Correct Number of Strands
☐ ☐ Debonds Required?
☐ ☐ Are strands in the casting beds straight (not crossing over each other)?
☐ ☐ **QC PRESENT at TIME of STRESSING?**
☐ ☐ Is Plant using two-pressure gauge system (One pressure gauge and one load cell gauge?)
☐ ☐ If epoxy-coated strands are used, were strand nicked/damaged during stressing?
If Yes, Did Plant remove any damaged strands? ☐Yes ☐No
☐ ☐ Did strands seat properly when initial stress was pulled? Initial Force, P_{ji} =_______________
☐ ☐ D=Any strand slippage measured during final stressing? Final Force, P_{jf} =_______________
☐ ☐ Elongations within tolerance range Tolerance Range =_______________
If No Did QC make proper adjustments ☐Yes ☐No

Comments: ____

IDENTIFICATION/STORAGE & HANDLING

Yes No

☐ ☐ Are precast units clearly marked with identification as shown on the shop drawing? If no, contact QC.
☐ ☐ Are cast dates marked on the precast/prestressed unit? If no, contact QC.
☐ ☐ Are storage areas clean and free of debris?
☐ ☐ Are precast/prestressed units stored in the upright position?
☐ ☐ **QC PRESENT at POST-POUR INSPECTIONS?**
☐ ☐ Did QC verify unit dimension during post-pour inspection?
☐ ☐ Was camber checked? What is the age of the concrete: ________________
☐ ☐ Are units twisted or out of plumb in storage?

DAMAGE TO UNITS

Yes No

☐ ☐ Are units showing any damage in storage? If so, explain below.
☐ ☐ Does plant have repair procedures?
☐ ☐ Are units being handled carefully?
☐ ☐ Are units lifted properly?
☐ ☐ Are units properly braced?
☐ ☐ Are units stored on proper dunnage?

Comments: ____

REPAIR PROCEDURE

Yes No

☐ ☐ Have repair procedures been approved?
☐ ☐ Did contractor follow approved repair procedures?
☐ ☐ Did other damages occur during repair?
☐ ☐ Have products for repairs been approved?
☐ ☐ Does product have clearly marked batch numbers and lot numbers?
☐ ☐ Does contractor have COC and Green Tag Release on file of the products being used?

Comments: ____

METS PRECAST PLANT
SUPPLEMENTAL "*FINAL RELEASE*" CHECKLIST

Contract No: ______________________ Date: ______________________

RELEASE

Release with: ☐Orange Tag ☐Green Tag ☐Blue Tag ☐Other (if not release, explain)

Yes	No	N/A	
☐	☐	☐	Documentation of all rebar and associated pieces with COC.
☐	☐	☐	Batch Plant Materials COCs for
☐	☐	☐	Vendor's Certificate of Compliance for materials
☐	☐	☐	Moisture meter data
☐	☐	☐	Approved mix design
☐	☐	☐	Cylinder break data at
☐	☐	☐	Cylinder break data at
☐	☐	☐	Transfer/Break-out
☐	☐	☐	28-day strength
☐	☐	☐	Pre-pour inspection documentation from QC
☐	☐	☐	Post-pour inspection documentation from QC
☐	☐	☐	Documented repairs for concrete
☐	☐	☐	Materials used for repairs, including lot numbers, batch numbers and manufacturer
☐	☐	☐	List of personnel and time on all repairs
☐	☐	☐	Documentation of water curing start and completion dates
☐	☐	☐	Steam curing data and charts
☐	☐	☐	Batch tickets/reports
☐	☐	☐	Stressing calculation(s) sheets
☐	☐	☐	COC for unit
☐	☐	☐	Other testing data from contractor

*Comments:*____

Appendix I – QASI Branch Audit Checklist

OFFICE OF STRUCTURAL MATERIALS

QUALITY AND SOURCE INSPECTION BRANCH

INTERNAL AUDIT

NAME OF BRANCH: ______________________________

DATE: ______________________________

ORIGINAL OR FOLLOW-UP VISITS: ______________________________

NAME OF AUDITORS: ______________________________

LEGEND:

Black = Compliance/Satisfactory Reponses, General Observations, and Comments.

Red = Findings And Concerns.

Blue = Not Applicable (N/A) To This Facility Or Contract.

OFFICE OF STRUCTURAL MATERIALS
INTERNAL AUDIT CHECKLIST

The purpose of this audit is to identify areas of the Office of Structural Materials (OSM) Quality Assurance and Source Inspection (QASI) Branch operations that are performing well and identify areas that require additional time and resources. The following checklist provides general areas for review with the intent of improving efficiency in daily operations.

A. OPERATIONS MANAGEMENT

		YES	NO	NA	DETAILED INFORMATION
DISPATCH OPERATIONS					
1.	Does the Branch respond within a single business day to all inspection requests? *Copies of all inspection requests received yesterday with METS portion completed.*				
2.	Does the Branch have an effective system to manage the dispatching of inspectors? *# of inspection calls performed yesterday: _______* *# of inspection calls unable to respond to: ______*				
3.	Does the Branch have a system to prioritize inspection calls?				
4.	Does the Branch have a system to validate acceptable EAs prior to dispatching? *Access to TRAMS: YES / NO* *Walkthrough example of an EA to verify if it is valid..*				
5.	Do state personnel and consultant staff Lead Inspectors work jointly to dispatch respective personnel?				
SUBMITTALS					
6.	Does the Branch have a central location for receiving submittals?				
7.	Does the Branch have a current and updated submittal log to include due dates *# of WQCPs currently outstanding: ____* *# of WQCPs over 10 days old: _____* *# of other submittals overdue: _____*				

		YES	NO	NA	DETAILED INFORMATION
8.	Does Branch have an effective system to ensure timely completion of submittals?				
9.	Does Branch have a system to ensure a equitable distribution of submittals to inspectors performing review?				
MATERIALS TO BE USED					
10.	Does the Branch have an effective system to track and manage the receipt of all 3101s? *# of 3101s received in the past week: ___*				
11.	Does the Branch have an effective system to respond to all 3101s with a TL-608 or TL-28? *# of TL-28s sent out in last 5 days: ____* *# of TL-608s sent out in last 5 days: ____*				
12.	Does Branch have a system to evaluate bid items based off of OSM guidance documents?				
13.	Does Branch notify Sacramento of bid items or subcomponents not listed on the list?				
14.	Does the Branch have access to the METS database on the SM Common Folder to help facilitate the tracking of all 3101s?				
15.	Is clerical staff adequately trained on how to effectively track the receipt and response to 3101s? *Walkthrough an example of a 3101 with a selected clerical staff employee with a TL-608 and 28 response.*				

B. STRUCTURAL MATERIALS TESTING

		YES	NO	NA	DETAILED INFORMATION
1.	Does the Branch have a current and updated log of TL-101s?				
2.	Does the Branch have an effective method to notify inspectors of test results?				
3.	Does the Branch ensure material is tagged and released in a reasonable amount of time after receiving test results? # of TL-101s without a response: ______ # of days of oldest TL-101: _______				
4.	Does the Branch have access to the Structural Materials Testing Branch's Filemaker Pro database?				
5.	Are TL-101s filled out properly?				

C. FILING SYSTEM

		YES	NO	NA	DETAILED INFORMATION
1.	Does the Branch have adequate storage space for number of files?				
2.	Does the Branch have an effective system for creating files for new projects? *# of new files created in last 5 days: ____*				
3.	Does the Branch have designated locations for paperwork to be filed?				
4.	Is the Branch filing organization consistent with Section 1.16 of the OSMPP? *Review 2 to 3 random files to evaluate organization*				
5.	Are Branch files up to date? *Randomly select inspector to look for an inspection report performed and filed in last two weeks.+*				
6.	Is file organization listed or easy to understand? *Ask a member of clerical staff to find a TL-23 for a specific contract?*				
7.	Are files labeled with visible EA numbers?				

		YES	NO	NA	DETAILED INFORMATION
8.	Does Branch have system for closing out projects? *# of projects within area of responsibility closed out in last 30 days? _____* *# of projects outside area of responsibility closed out in last 30 days? _____*				
9.	Are other Branches notified of projects being closed out? *Method of notification: _____________* *System for tracking response: YES / NO*				
10.	Does Branch keep a log of all projects closed out?				
11.	Does Branch clerical staff understand differences in close out procedures for projects inside and outside Branch's area of responsibility?				
12.	Does Branch follow procedures for closeout procedures outlined in Section 1.17 of the OSMPP?				
13.	Does Branch have a system to file all inspection requests?				
14.	Does Branch maintain a file of all OSM / METS policies and memorandums?				
15.	Does Branch maintain files on manufacturers or fabricators that the Branch green-tags "stock" material?				

C. EQUIPMENT

		YES	NO	NA	DETAILED INFORMATION
1.	Does the Branch have a system for managing location and inventory of computers? *Select two items from list to verify location.*				
2.	Does the Branch have a system for managing assignments of vehicles? *Verify two vehicles from master list.*				

		YES	NO	NA	DETAILED INFORMATION
3.	Does the Branch have a system for managing assignment, maintenance, and calibration of inspection equipment? *Verify assignment by SN of two pieces of equipment.* *Verify calibration of two pieces of equipment.*				
4.	Does Branch have a secure storage area to store equipment?				
5.	Are personnel maintaining equipment properly? *Randomly inspect equipment during inspection visit.*				

C. PERSONNEL

		YES	NO	NA	DETAILED INFORMATION
TRAINING					
1.	Is training schedule posted with dates and topics?				
2.	Does Branch Senior approve absences from required training? *# of inspectors that did not attend last NDT training:* __________ *# of inspectors that did not attend last quarterly training:* ___________				
3.	Are Safety meetings being held every 10 working days? *Copies of last two meeting minutes*				
4.	Are Safety meeting notes from last meeting posted ?				
CERTIFICATIONS					
5.	Does Branch have a current list of personnel certifications with expiration dates?				
6.	Are NDT Inspection binder being maintained?				
7.	Does Branch have a system to ensure inspectors receive adequate experience to maintain certifications?				

LEAD INSPECTORS					
8.	Are all inspectors assigned to a Lead Inspector? *List of assignments*				
9.	Do Lead Inspectors review and sign all reports by inspectors? *List of reports reviewed by two randomly selected Lead Inspectors in the past 5 days*				
10.	Are Lead Inspectors forwarding reports to the BS, RE, SR, and SMR IAW Section 1.2 of the OSMPP? *Randomly select two Lead Inspectors to see "Sent Items" folder on email.*				
11.	Does Branch have a system to ensure hard copies of reports and supporting documentation are grouped together before filing? *Interview two Lead Inspectors to evaluate system they use to receive and distribute supporting documentation with inspection reports.*				
12.	Has a QA Lead verifications been performed on each inspector within the last two weeks? *Randomly select two Lead Inspectors and ask for most recent Lead Verification on each inspector assigned.*				
13.	Do Lead Inspectors have an effective system to track information for monthly summary report? *Review two Lead Inspectors' systems for tracking and reporting data for monthly summary report*				
INSPECTORS: Audit performed through two unannounced visits to source where inspections are being performed.					
14.	Does inspector have a current copy of the OSMPP?				
15.	Is inspector using current forms?				
16.	Does inspector have appropriate contract documents to perform inspections? (i.e. special provisions, shop plans, etc).				

17.	Does inspector have a thorough understanding of contractor quality control operations?				
18.	Is inspector familiar with specified procedures in OSMPP for material being inspected?				
19.	Does inspector have access to updated EA information to include RE name and address?				
20.	Does inspector have access to SMMS?				
21.	Is inspector up to date on inspection reports completed? *View sent items folder to observe inspection reports sent to Lead Inspector*				
SMRs					
22.	Do SMRs have a current NCR tracking log?				
	Is Branch conducting SMR/Lead Inspector meetings at the published dates and times?				
	Does Branch have a speaker phone at SMR/Lead Inspector meetings to facilitate out of town participants?				
	Are SMRs reviewing project correspondence?				
	Do SMRs have a system to document conversations and project-specific activities?				
	Does SMR have a system to ensure METS database is updated with current EA information?				
ADMINISTRATIVE STAFF					
	Does Branch Admin Staff have access to METS database?				
	Does Admin Staff inform the appropriate SMR when EA info is incorrect?				
	Does Admin Staff track all 3101s received?				
	Does Admin Staff work closely with SMRs to determine which bid items require a TL-608 or TL-28?				
	Is Admin Staff mailing TL-608s and TL-28s to appropriate personnel?				
	Is Admin staff up to date on filing?				

	Does Admin staff mail hard copies of inspection reports to personnel annotated at the bottom of each form? *Randomly open two envelopes from outgoing mail box.*				
	Do Admin Staff have a copy of the OSMPP?				
	Do Admin Staff follow project closeout procedures in OSMPP?				

INTERNAL AUDIT PERFORMED BY:
NAME:________________________

POSITION:_____________________

BRANCH:______________________

REMARKS:____

____

____

____

____

Appendix J - Welding and Steel Checklist

WELDING AND STEEL INSPECTION CHECKLIST

FABRICATORS NAME______________________________ **INSPECTORS NAME (printed)**_________________________
CITY, STATE: __________________________________ **DATE:**____

CONTRACT NUMBER_______________ **BID ITEM NUMBER**_______________ **DESCRIPTION**_______________________________
CONTRACT NUMBER_______________ **BID ITEM NUMBER**_______________ **DESCRIPTION**_______________________________
CONTRACT NUMBER_______________ **BID ITEM NUMBER**_______________ **DESCRIPTION**_______________________________

I. SPECIFICATION REVIEW:

.

		CONFORMANCE		
		YES	**NO**	*NA*
1..	Has QA reviewed the Special Provisions, applicable contract documents and codes?			
2.	Are Caltrans stamped drawings available at the shop?			
3.	Are contract specified codes available at the shop?			

II. MATERIAL VERIFICATION:

		CONFORMANCE		
		YES	**NO**	**NA**
1.	Are mill orders, mill test reports, and certificates of compliance available?			
2.	Do the items there were randomly inspected meet the contract requirements?			
3.	If toughness requirements specified have Charpy V-notch tests been performed?			
4	Do heat #s correspond to mill test reports and marking?			
5.	If contact governed by "Buy America Act", are domestic certifications provided?			
6.	Are any obvious surface defects visible on material?			
7.	Have check test samples been selected and witnessed for FCMs?			
8.	Do MTRs meet physical and chemical test requirements?			

III. WELDING QUALITY ASSURANCE PROCEDURES

		CONFORMANCE		
		YES	**NO**	**NA**
1.	Was a Welding Quality Control Plan (WQCP) submitted, approved and available?		Sec	Secti
2.	Is QC inspector currently certified as a CWI and approved in WQCP?			
3.	Are QC Assistants currently certified as AWS CAWIs?			
4.	Has QC inspected and approved Joint preparation and assembly practice?			
5.	Are randomly selected welders qualified by Caltrans, current, and listed in WQCP?			
6.	Are WPSs being - used those specified in the WQCP?			
7.	Are WPSs available to each welder and inspector?			
8.	Is the QC Inspector present to ensure inspection does not lapse more than 30 minutes?			
9.	Are all NDT technicians listed in the WQCP?			

IV. WELDING (RANDOM CHECKS – VERIFY WITH APPROVED WQCP/WPS)
For the welds that were randomly inspected

		CONFORMANCE		
		YES	**NO**	**NA**
1.	Wind and temperature acceptable			
2.	Welding consumables and electrode requirements			
3.	Heat input controlled for Q & T Steels			
4.	Welding parameters as measured: amps/volts (AWS D1,1, Sec. 5.5)/AWS D1.5, Sec 5.13)			
5.	Root opening and groove angle (WQCP, AWS D1.1, Figs. 3.3 or 3.4, 5.22/(AWS D1.5 5.13)			
6.	Preparation of base metal (AWS D1.1, Sec 5.15/(AWS D1.5 Sec. 3.2)			
7.	Preheat and interpass temperature (AWS D1.1, Sec. 5.6)/(AWS D1.5, Sec. 4.2)			
8.	Root pass width and height (AWS D1.1, Sec. 3.7)/(AWS D1.5, Sec. 3.3)			
9.	Interpass cleaning (AWS D1.1, Sec. 5.30)/(AWS D1.5, Sec. 3.11)			
10.	Backing, tack welds, assembly and fit-up (AWS D1.1, Sec 5.10, 5.18)/(AWS D1.5, Sec. 3.3, 3.13)			
11.	Welding sequence (AWS D1.1, Sec. 5.21)/(AWS D1.5 Sec. 3.4)			
12.	Electrodes (AWS D1.1, Sec. 5.21)/(AWS D.1.5, Sec. 5.5)			
13,	Weld repairs (AWS D1.1, Sec. 5.26)/(AWS D.5, Sec. 3.7)			
14.	Final Weld Finish (Visual inspection of the Welds) (AWS D1.1, Sec. 5.24)/(AWS D1.5, Sec. 3.6)			

V. FABRICATION /FINAL INSPECTION

		CONFORMANCE		
		YES	NO	NA
1.	Cutting of material (notches, reentrant corners, surface roughness, etc.)			
2.	Bolt holes			
3.	Bent plates			
4.	Fit of Stiffeners			
5.	Shop assembly			
6.	Bolted splices			
7.	Flatness of bearing surfaces			
8.	Base metal prepared correctly and no observed rejectable discontinuities			
9.	Warpage and distortion			
10.	Stress relief heat treatment correctly performed when required			
11.	Minimum fillet weld size			
12.	Camber			
13.	Dimensional tolerances of structural members			
14.	Weld profiles			
15.	Repairs IAW WQP and code			
16.	Peening			
17.	Caulking			
18.	Arc strikes			
19	Weld cleaning			
20.	Weld tabs removed prior to NDT			
21.	Was NDT performed IAW WQCP?			
22.	Was appropriate amount and type of NDT performed?			
23.	QA's 10% NDT verification was acceptable			
24.	Overall dimensions of QA verified items are according to plans			
Additional Requirements for Signal, Lighting or Sign Structures:				
25.	Hand holes and conduit/conductor hole in proper location and not flame cuts			
26.	Random verification that bolt/cap screw holes have the proper diameter			
27.	Random verification that welds are ground flush with base metal (Std Specs, 86-2.04)			
28.	Contact surfaces of joints appear flat and free of burrs; exposed edges finished smooth			
29.	Welds on anchor bolts, if required; not allowed on HS anchor bolts			
30.	Identification plates readable with required information; and attached correctly			
31.	Galvanized faying surfaces of bolted connections wire brushed by hand			

VI. DOCUMENTATION

		CONFORMANCE		
		YES	NO	NA
1.	Is a Daily Production Log kept by the OCM (location of welds, welder ID, and Daily CWI Report			
2.	Are welding reports being submitted to the engineer for review (documentation of visual inspection and Daily Production Log?			
3.	Is material used during production properly tracked by QC during production?			
4.	Are welds being properly tracked by QC during production per approved WQCP?			

ADDITIONAL COMMENTS:

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INSPECTOR'S SIGNATURE:____________________ **DATE:**__________